WATER RESOURCES AUTHORITY
MASSACHUSETTS

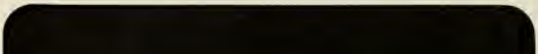
Secondary Treatment Facilities Plan

Facilities Planning Background

Volume II

DRAFT REPORT

September 15, 1987



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Notice to Reviewers

Attached for your review is the draft report of Volume II, Facilities Planning Background of the Secondary Treatment Facilities Plan.

To date this document has received MWRA staff review. The MWRA Board of Directors has been briefed on the contents of the draft report, but no approval will be issued until the public review process is complete. The draft report is being circulated at this time to seek early review and comment by interested parties. Comments will be presented to the Board of Directors as they continue their review of the draft report.

Information in this report is current as of September 15, 1987.

Daniel K. O'Brien
Acting Director
Engineering Division
September 15, 1987

HOW TO USE THE SECONDARY TREATMENT FACILITIES PLAN

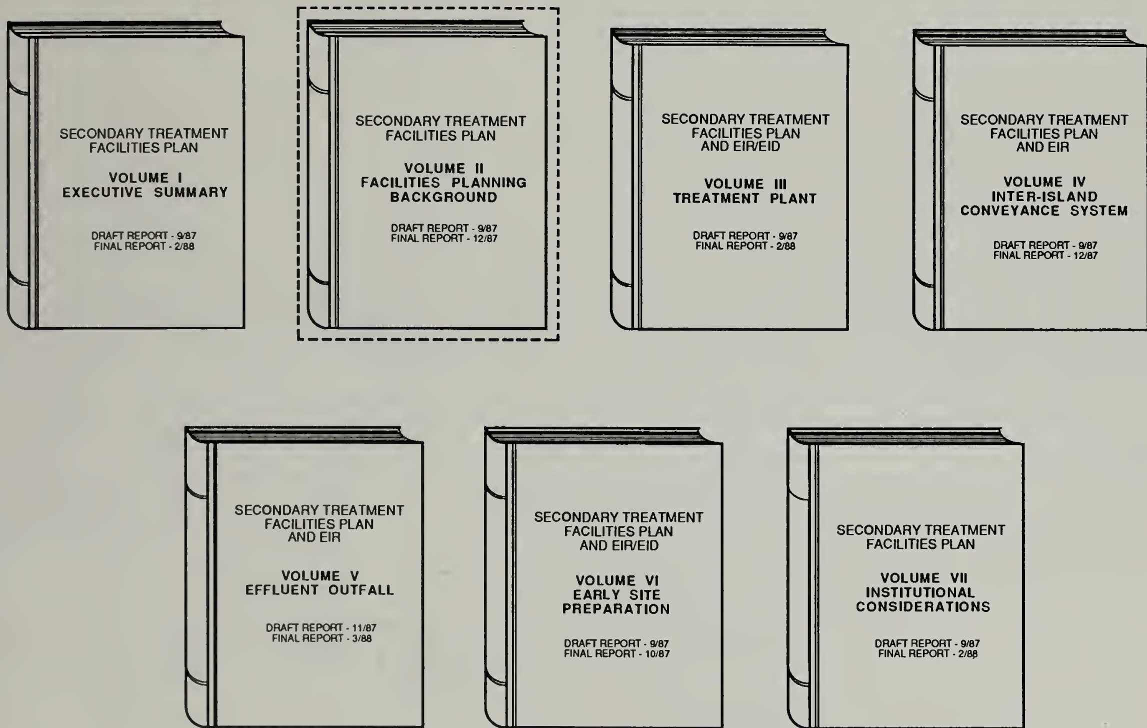
The Secondary Treatment Facilities Plan is organized into seven volumes.

The major components of the Secondary Treatment Facilities Plan are: Treatment Plant, Inter-Island Conveyance, Effluent Outfall, and Early Site Preparation.

The Secondary Treatment Facilities Plan document consists of a stand-alone volume for each of these components as well as volumes for Facilities Planning Background, Institutional Considerations, and Executive Summary.

Each volume may be referenced to find complete planning information pursuant to that project component. The seven volumes are numbered as follows:

Volume I	Executive Summary
Volume II	Facilities Planning Background
Volume III	Treatment Plant
Volume IV	Inter-Island Conveyance System
Volume V	Effluent Outfall
Volume VI	Early Site Preparation
Volume VII	Institutional Considerations



MASSACHUSETTS
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DEER ISLAND
SECONDARY TREATMENT FACILITIES PLAN
VOLUMES

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Section 1

SECTION 1.0 SUMMARY

1.1 PROJECT IDENTIFICATION

The following is Volume II, Facilities Planning Background, of the Secondary Treatment Facilities Plan. It is one of seven volumes that constitute the entire plan.

1.2 BRIEF DESCRIPTION OF PROJECT

The Secondary Treatment Facilities Plan evaluates the facilities needed to provide primary and secondary treatment of the wastewater conveyed through the Massachusetts Water Resources Authority's North and South Sewerage Collection Systems at a single treatment facility to be located on Deer Island. The Facilities Plan also evaluates the facilities needed to convey the South System flows from the existing Nut Island Plant to Deer Island, and the outfall facilities needed to convey the combined flows from Deer Island to a disposal point in marine waters.

This report describes the study, the work plan, and those factors that are common background for the detailed planning for the above described facilities.

Volume II, Facilities Planning Background, describes the need for the planning project and how it was accomplished. It summarizes previous studies for the clean-up of Boston Harbor and other, related harbor clean-up projects. It also outlines the process of decision making in the siting of the new facilities, and the court-ordered dates for completion of the Facilities Plan.

Volume II describes the planning period and the service area for the facilities, and criteria used to evalute all of the possible treatment processes in order to determine the most feasible, effective methods of treatment and their costs.

This volume examines the existing treatment facilities, environments, regulations, projected flows and loadings, and also outlines the environmental regulations that will impact the construction of the planned facilities.

Section 2

2.0 INTRODUCTION

2.1 PROJECT NEED

Since the time of the Revolutionary War, Boston Harbor has been considered a national landmark. The largest seaport in New England, it supports a variety of marine activities including shipping, fishing, boating and recreation. It encompasses an area of 47 square miles bordered by residences, commercial buildings, restaurants, marinas, beaches, industries and shellfishing flats. But since the settlement of Boston's shore areas, and most particularly since the City of Boston took possession of Deer Island for "sanitary purposes" in 1847, the Harbor has served as a repository for all of the domestic, commercial and industrial sewage and stormwater from the Boston metropolitan area.

Today, nearly 5,000 miles of sewers, conduits and pipes collect sewage from 1.9 million people and 43 metropolitan cities and towns and transport it to the area's two sewage treatment plants at Nut Island and Deer Island for treatment prior to discharge to Boston Harbor. Both of the plants are designed to provide primary treatment. Each plant provides disinfection of the primary effluent prior to discharge to the Harbor to reduce the levels of pathogenic bacteria. The disinfected effluent from Deer Island is discharged through two diffuser equipped outfalls into President Roads approximately 1,500-2,000 feet from Deer Island. Three additional relief outfalls are located 500-750 feet from Deer Island.

The disinfected effluent from Nut Island is discharged north through two main outfalls into Nantasket Roads approximately 4,500-5,000 feet from Nut Island. During periods of high flows and/or extremely high tides a third outfall extending about 1,500 feet north into West Gut may be used. In addition, an emergency outfall extends 500 feet into the Hingham Bay side of West Gut.

The sludges removed from both plants are stabilized and discharged into President Roads on the outgoing tide. Figure 2.1-1 illustrates the location of each of the treatment facilities and discharge locations. The combined discharge of primary effluent and sludge to the relatively shallow waters of Boston Harbor imposes a significant burden on the marine ecology in the waters surrounding the discharge. The discharge of floatable materials results in a significant deterioration in the aesthetic qualities of this vital resource. Because these discharges are but a few of the total discharges to Boston Harbor, and because scientific research to delineate the impacts of each discharge on the harbor has been limited to date, the precise impacts of the primary effluent and sludge are difficult to quantify. However, these discharges are unquestionably very sizable and the materials being discharged are ecologically significant. Thus, every reasonable effort should be made to reduce these discharges.

The Deer Island treatment facilities were constructed in 1968, and the Nut Island treatment facilities in 1952. Both facilities have exceeded their useful lives and the levels of treatment provided are often less than optimal because of the unavailability of equipment. Nut Island has recently undergone a rehabilitation of most of its major components. A similar rehabilitation is now underway for Deer Island. Rehabilitation of the existing treatment

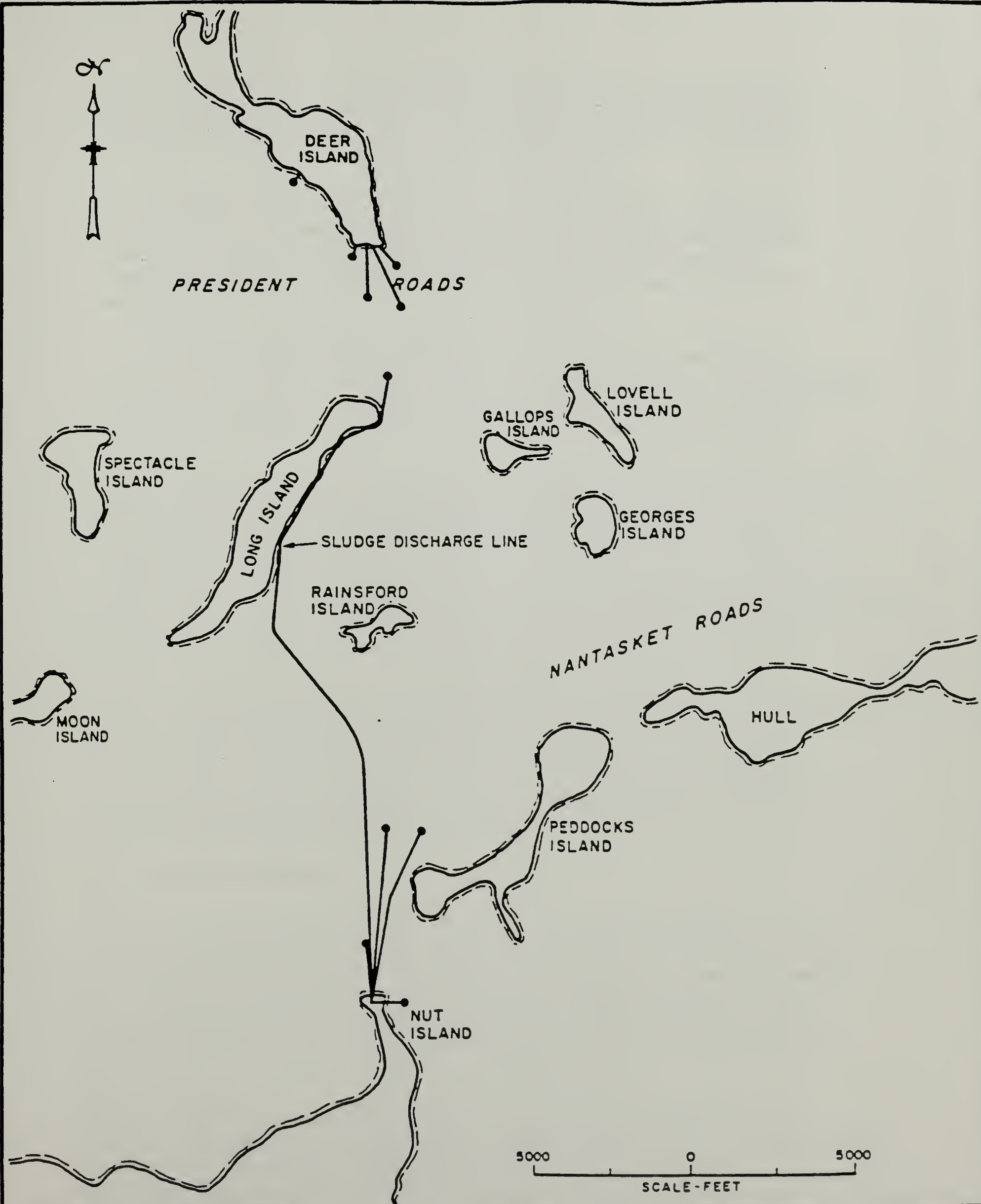

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FIGURE 2.1-1
DEER ISLAND AND NUT ISLAND EFFLUENT AND SLUDGE DISCHARGE LOCATIONS

facilities will optimize the levels of removal that these facilities can consistently provide. However, even the rehabilitated facilities cannot provide the levels of treatment desired. The design criteria and installed equipment of the existing primary facilities do not represent state-of-the art technology; therefore, they require replacement.

The 1972 Federal Clean Water Act requires that all municipal sewage treatment systems incorporate secondary treatment. Secondary treatment is more complex than the primary treatment that the flows at Nut Island and Deer Island currently receive, removing significantly higher levels of both organic materials and solids from wastewater (80 to 90 percent).

Like the Federal Water Pollution Control Act, the Massachusetts Clean Water Act requires promulgation of water quality standards for waters within the Commonwealth. The Massachusetts Division of Water Pollution Control has established these standards to satisfy the requirements of both acts. Thus, both Federal and State statutes require increased levels of treatment.

In 1982, the City of Quincy filed a suit against the Metropolitan District Commission (MWRA's predecessor agency) charging violations of laws prohibiting discharges into coastal waters and tidal waters, and violations of the common law of nuisance. As the suit progressed, the Massachusetts Water Resources Authority was created by the Massachusetts legislature. Almost simultaneously with MWRA's creation, the U.S. Environmental Protection Agency filed suit against MWRA alleging violations of the Clean Water Act. The Federal District Court found MWRA to be in violation and ordered the Authority to plan and construct new treatment facilities in accordance with an aggressive schedule (see Section 3.4.)

The need for upgraded and expanded treatment facilities to serve the Boston metropolitan area is clear: current discharges place a significant burden on one of the area's vital natural resources; the existing treatment facilities have long exceeded their useful lives; the existing treatment facilities do not reflect state-of-the-art technology and design; Federal and State statutes require enhanced levels of treatment; and the Federal Court has intervened and ordered an upgrading of the treatment facilities.

2.2 PLANNING APPROACH

This facilities planning study provides the foundation for the Massachusetts Water Resources Authority's program for the construction and operation of new primary and secondary wastewater treatment facilities at Deer Island. This planning has been approached with the understanding that the facilities planning effort must secure and sustain the acceptance and support of the diverse community, government and business interests that it affects. Therefore, the planning process was based not on technical strength alone, but also on the continual reconciliation of political, legal, environmental, economic and community interests.

A critical component of the facilities planning for secondary treatment facilities has been completed: the siting of the new treatment facilities. The decision-making process and the mitigation commitments made during that siting process are considered to be firm guidance for the planning to be undertaken in this project. (See Section 3.2 for a description of the

siting decision.)

The successful treatment of wastewaters from the Boston metropolitan area requires not only that enhanced treatment facilities be provided, but also that reliable, environmentally sound facilities be provided to manage the disposal of the residuals that are the direct by-products of wastewater treatment. The residuals management facilities plan is being conducted as a separate but concurrent study. The facilities needed and the sites being considered for residuals management are quite different from those needed for secondary treatment. However, the schedule for completion of the residuals management facilities plan is similar to the schedule for this plan. In addition, the approach and work plans for both of these planning studies recognize the synergistic relationship of these two plans. Thus, this planning study must be read with full cognizance of the residuals management facilities planning.

The facilities needed to provide secondary treatment include new primary and secondary treatment facilities located on Deer Island; a new conduit to convey the wastewaters from the existing Nut Island plant to Deer Island (inter-island conveyance facilities); and a new outfall to discharge the treated effluent into the ocean. In addition, a fourth component has been identified for the project: early site preparation. Early site preparation is defined as any construction activity that can start at an early date, i.e., before the completion of the on-island piers facilities needed to move the construction materials, equipment and personnel to the Deer Island site. The facilities planning for secondary treatment has thus been broken into four, stand-alone studies:

Treatment Plant, Volume III
Inter-Island Conveyance System, Volume IV
Effluent Outfall, Volume V
Early Site Preparation, Volume VI

To expedite the planning and review process, the facilities planning for secondary treatment has received a designation as a "major and complicated" project under the Massachusetts Environmental Policy Act regulations. The "major and complicated" project designation permits the environmental reviews to be concurrent with, and an integral part of, the facilities planning process. Thus, the documents being prepared to summarize the facilities planning are the same documents which will be used for environmental reviews.

The scope and sequencing of these facilities planning and environmental review activities are described in the following section.

2.3 SCOPE OF WORK

The purpose of the Secondary Treatment Facilities Plan is to evaluate the facilities needed to provide primary and secondary treatment, at a single facility to be located on Deer Island, of the wastewater conveyed through MWRA's North and South Systems. It will evaluate the facilities needed to convey the South System flows from the existing Nut Island plant to Deer Island, as well as the outfall facilities needed to convey the effluent flows from Deer Island

to a disposal point in marine waters. It will also identify and evaluate the construction activities which can occur as part of the Early Site Preparation effort prior to completion of the on-island piers and in preparation for the construction of the primary facilities.

The scope of work for the facilities plan is summarized below.

Project Management provides the overall project management required to ensure that the facilities plan is completed on time, within budget and with high standards of quality.

Data Collection inventories current and planned upgraded equipment and processes, assembles data regarding process equipment, mechanical, structural and hydraulic conditions, operating and maintenance characteristics, and expected useful life. Data Collection also will project flows and loadings, define the planning area, and provide a basis for evaluating further growth. This task will develop performance/removal criteria that will be used to balance the level of treatment required and the outfall location.

Facilities Engineering will characterize the wastewater to be treated, develop initial alternative planning and architectural concepts for Deer Island and ancillary facilities at Nut Island; complete site planning requirements; evaluate the adequacy of existing preliminary treatment facilities and evaluate unit processes for screening and grit removal; evaluate unit processes for primary treatment and residuals collection; evaluate unit processes for secondary treatment and residual collection; evaluate unit processes for disinfection; identify and evaluate the ability to control air emissions; establish alternative noise control methods and prepare a noise control plan for treatment plant operations and construction activities; determine the need for a pilot plant; evaluate the route and construction technology for locating and constructing the inter-island conveyance system and new effluent outfall; select an area for the outfall discharge which will meet water quality standards; characterize the soil and rock conditions under the proposed facility and related wastewater conveyance systems; identify and evaluate treatment processes; evaluate the reliability and flexibility of each of the treatment alternatives; estimate capital costs for the selected facilities and equipment; identify and estimate utility needs; identify operator needs and develop a preliminary operations plan; outline the requirements to operate the existing plants during construction; and provide pre-construction planning.

Institutional tasks include development of an annual cash flow projection required for the construction of the facilities; identification of the financial impacts of the recommended plan on MWRA's customers; identification of proposed changes or additional laws, regulations, legislative restrictions and agreements that may affect the implementation of the facilities plan; description of potential permit and regulatory agency approval requirements and preparation of a preliminary permitting plan; and implementation of a full-scale public participation program.

Recommended Plan is the preparation of the Secondary Treatment Facilities Plan and development of an implementation schedule/plan for each design and construction phase, as well as the coordination of, and response to, reviews by regulatory agencies.

A more detailed outline of each work task will be found in Appendix A. Figure 2.3-1 illustrates the general flow of the planning activities.

SCHEDULE OF MAJOR DELIVERABLES

VOLUME	NAME	DRAFT REPORT	FINAL REPORT
I	EXECUTIVE SUMMARY	9/87	2/88
II	FACILITIES PLANNING BACKGROUND	9/87	12/87
III	TREATMENT PLANT	9/87	2/88
IV	INTER-ISLAND CONVEYANCE SYSTEM	9/87	12/87
V	EFFLUENT OUTFALL	11/87	3/88
VI	EARLY SITE PREPARATION	9/87	10/87
VII	INSTITUTIONAL CONSIDERATIONS	9/87	2/88

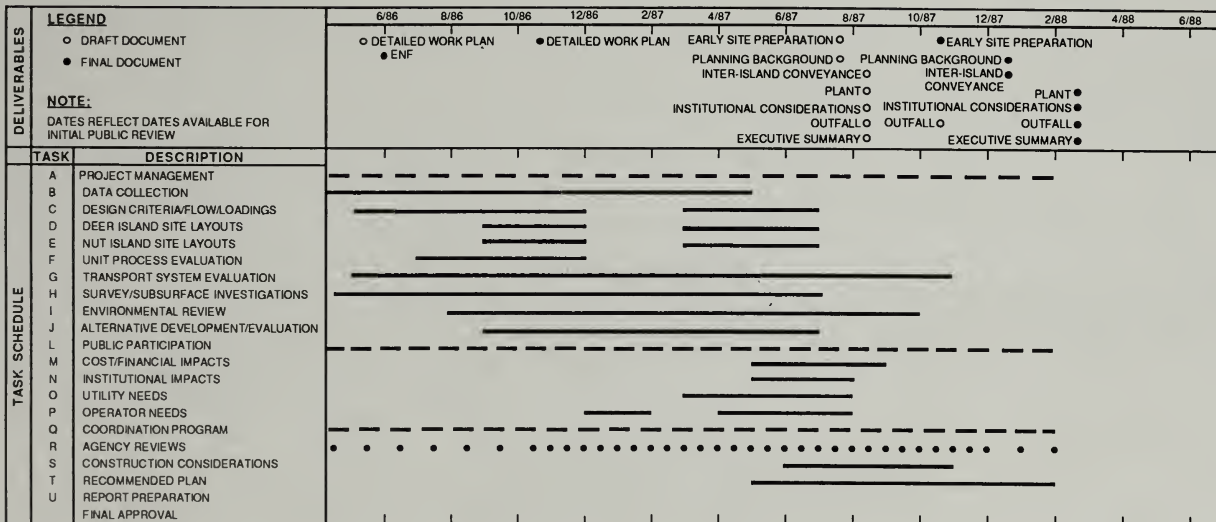

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FIGURE 2.3-1
SECONDARY TREATMENT FACILITIES PLAN
PROJECT SCHEDULE

Section 3

3.0 PROJECT BACKGROUND

3.1 PREVIOUS STUDIES

Since 1900, there has been concern over water pollution problems in Boston Harbor. The State legislature initiated six investigations into the condition of the Harbor between 1900 and 1939. The last of these investigations resulted in the construction of the present Deer Island Treatment Plant which was completed in 1968.

But even as the Deer Island Plant was completed, the Federal Water Pollution Control Administration released a report on the impact of pollution on the Harbor's waters citing recreational, economic and biological impairment. The report generated increased interest in addressing pollution problems and at the first Enforcement Conference on Boston Harbor, state and federal officials agreed on the formation of a technical study group to explore measures for pollution abatement. The recommendations and agreements which grew out of these conferences, in conjunction with the mandates of the Federal Water Pollution Control Act and the Massachusetts Clean Water Act, have formed the framework for attacking pollution in Boston Harbor.

The process of identifying long-term wastewater treatment needs and solutions for the greater Boston Metropolitan area began in 1973 when the Metropolitan District Commission (MDC) began work on wastewater engineering and management planning for Boston Harbor. (See Table 3-1 for a list of planning reports for wastewater treatment in Boston Harbor). The Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study (EMMA) was to ascertain what repair, replacement, extension, and expansion of facilities was required to provide adequate sewage treatment for the next fifty years.

In the fall of 1976, following publication of the EMMA Study, EPA's regional office requested that an Environmental Impact Statement (EIS) be prepared before any facilities planning. When the draft EIS was completed in 1978, it resolved the controversy regarding satellite facilities and proposed the consolidation of all planned treatment facilities on Deer Island.

A few months prior to the publication of the EIS, the MDC had responded to the 1977 amendments to the Clean Water Act which provided for a waiver of secondary treatment. If a waiver were granted, much of the construction contemplated in the EMMA Study would be deferred, at least until expiration of the modified permit, and perhaps indefinitely if the permit were renewed. Nevertheless, because regulations pertaining to the waiver process required that facilities plans to provide secondary treatment be prepared concurrent with the waiver process, the MDC, following release of the draft EIS, began preparation of a facilities plan.

Starting in 1983, the EPA and the Commonwealth jointly prepared the Supplemental Environmental Impact Statement/ Environmental Impact Report on the Site Options Study. The purpose of this document, which augmented the EIS evaluations done on the EMMA Study, was to review the environmental impacts of the Site Options Study alternatives, as well as other alternatives within the context of both the National and Massachusetts Environmental Policy Acts. The SEIS/DEIR started with twenty alternatives and selected seven treatment plant siting

alternatives for final review. The MWRA later reinstated one alternative for final review. Four alternatives involved secondary treatment and four involved primary treatment. The alternatives considered included locating all treatment at Deer Island, all treatment at Long Island, or combinations of plant locations that used Deer, Long and Nut Islands together in various configurations.

Also in 1983, almost five years after MDC filed a preliminary application for waiver of secondary treatment, the application was tentatively denied by EPA. Because of intervening regulatory developments, MDC was entitled to file an amended application. Shortly thereafter, MDC notified EPA of its intent to do so, and a scope of study was agreed upon, including water sampling to be performed in the summer of 1984. Final submissions were made by MDC in October, 1984.

Although the cost implications of secondary treatment and the ultimate rate-payer impacts promoted pursuit of the waiver application over several years, the waiver application exacerbated two major problems in planning the cleanup of Boston Harbor. First, as long as the "level" of treatment (secondary vs primary) was uncertain, the nature and size of new treatment facilities were impossible to fix for planning purposes. Second, planning for sludge management was frustrated because of the disparity in both the tonnage and character of sludge from secondary treatment as opposed to primary treatment.

On March 29, 1985, EPA rejected MDC's amended Section 301 (h) waiver application.

The Massachusetts Water Resources Authority assumed control of the MDC sewerage system on July 1, 1985. The MWRA made the decision to proceed as fast as possible with the secondary treatment program for Boston Harbor, notifying EPA that they would choose a preferred alternative for focused analysis by early July, 1985.

Table 3-1 is a listing of planning projects undertaken for Boston Harbor wastewater treatment since the 1976 EMMA study.

TABLE 3.1-1

SUMMARY OF PLANNING REPORTS FOR WASTEWATER TREATMENT IN BOSTON HARBOR

1976, March	Eastern Massachusetts Metropolitan Area Wastewater Engineering and Management Plan of Boston Harbor, Metcalf & Eddy, Inc.
1976	Non-structural Controls for Combined Sewer Overflows, Environmental Research and Technology, Inc.
1976, May	Joint Task Force Report on Major Manned MDC Facilities located in the Greater Boston Area, EPA Region 1
1976, July	Wastewater Management Planning: Boston Metropolitan Area Phase I Study, Urban Systems Research and Engineering, Inc.
1976, July	Phase I Engineering Report Boston Case Study, Kennedy Engineers, Inc.
1976, August	Phase I Final Report on Greater Boston Water Quality Issues in Planning for Pollution Control, Verlex Corp.
1976, November	Boston Metropolitan Area Waste Treatment Feasibility Study, Stone & Webster Engineering Corp.
1979, January	Wastewater Treatment Facilities Planning in the Boston Metropolitan Area - A Case Study, Kennedy Engineers, Inc.
1979, September	Application for Modification of Secondary Treatment Requirements for Discharge into Marine Waters of Boston Harbor and Massachusetts Bay for its Deer Island and Nut Island Wastewater Treatment Plants, MDC
1980, December	MDC Headworks Grit and Screenings Removal Systems - Preliminary Report, Whitman and Howard, Inc.
1982, June	The Commonwealth of Massachusetts Nut Island Wastewater Treatment Plant Facilities Planning Project, Phase I, Site Options Study, Volumes I and II, Metcalf & Eddy, Inc.
1982	Nut Island Wastewater Treatment Plant Immediate Upgrading, Metcalf & Eddy, Inc
1984	Deer Island Facilities Plan, Havens & Emerson/Parsons Brinkerhoff
1984	Supplemental Draft Environmental Impact Statement and Draft Environmental

	Impact Report. EPA
1984	Application for a Waiver of Secondary Treatment for the Nut Island and Deer Island Treatment Plants. Metcalf & Eddy, Inc.
1985, November	Final Environmental Impact Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Camp Dresser & McKee. Inc.
1985, December	Final Environmental Impact Statement on Siting of Wastewater Treatment Facilities for Boston Harbor. EPA

3.2 SITING DECISION

The MWRA determined that the seriousness of the siting decision to be made and the newness of the MWRA as a participant in the decision process merited a thorough review of the material presented in the SDEIS/DEIR and comments made pursuant to that document, as well as a consideration of all additional information being developed in response to the issues raised by those comments.

The MWRA began its site selection process by reviewing the six criteria established in the SDEIS/DEIR (i.e., cost, effect on natural and cultural resources, effects on neighbors, harbor enhancement, implementability, and reliability). The MWRA voted to adopt these six criteria, but determined that two additional criteria should be adopted as well: equitable distribution of regional responsibility; and mitigation measures. The first of the new criteria, equitable distribution of regional responsibility, was viewed as subsuming the "fairness" issue which had been the subject of substantial commentary on the SDEIS/DEIR. The second new criterion, mitigation measures, was adopted to ensure consideration of both environmental and non-environmental mitigation and to permit the MWRA to fully respond to mitigation concerns during its siting deliberations.

The MWRA next reviewed the site options to be considered. It voted to examine the seven site alternatives proposed at the conclusion of the SDEIS/DEIR (all secondary Deer Island, split secondary Deer Island and Nut Island, all secondary Long Island, split secondary Deer Island and Long Island, all primary Deer Island, split primary Deer Island and Nut Island, split primary Deer Island and Long Island) and, in response to the Secretary's Certificate of Adequacy on the SDEIS/DEIR, also voted to reinstate for evaluation one site option that had been dropped from consideration at the close of the SDEIS/DEIR (all primary Long Island).

The MWRA then proceeded to an evaluation of each site alternative in the context of the criteria selected. A number of consultants were engaged to assist in the collection, evaluation and presentation of pertinent materials to the Board members at their publicly held meetings. Oral and visual presentations on each of the eight criteria were given, followed by questions and discussions which refined the issues to be addressed and identified further information to be obtained. Second presentations and discussions were held on seven of the criteria, and a third round of review and debate occurred on the criterion of cost. As a consequence of these deliberations, further presentations and discussions were held on several sub-topics that were of particular interest or thought to require additional attention.

In addition to its own consultants' presentations, the MWRA heard and discussed presentations by the Regional Administrator of EPA, by representatives of the Executive Office of Environmental Affairs and the Department of Environmental Quality Engineering, and by the technical and legal representatives of the Town of Winthrop and the City of Quincy. In all, the MWRA listened to and discussed at some length, 23 separate presentations on 13 different topics applicable to the preferred alternative siting decision.

A summary of all the siting presentations given and the Board's discussions was provided to the Board members for further review and analysis prior to the vote on the tentative preferred

alternative site selection. Copies of letters from officials and the public concerning the siting decision were either provided to Board members during the ongoing deliberations or were included in the siting summary notebook. The Board members also visited the sites being considered.

The following sub-sections contain summaries of the MWRA's deliberations concerning each criterion as it applied to the site selection to be made. Throughout the process of selecting the tentative preferred alternative site, the MWRA evaluated and compared the information received in light of the criteria adopted. It observed interrelationships among the criteria and discussed the value to be accorded to the criteria in the context of various site alternatives. The last sub-section summarizes the way in which the criteria weighed one against the other with respect to the sites considered.

Effect on Neighbors

The purpose of this criterion was to address treatment facility impacts on the neighbors of the treatment plant. Factors evaluated by the MWRA were traffic, noise, odor, visual effects, property values, and health and safety issues. An exploration of the numbers of persons potentially impacted by the proposed primary, secondary and split treatment plant site options was conducted. Distinctions were made between those who might be voluntarily exposed to the negative impacts and those who resided nearby and had no choice with respect to being impacted, with greater value being accorded to the latter. Consideration was also given to the potential impact of the treatment plant on those working, living or staying at either the hospital on Long Island or the prison on Deer Island. Weight was attached to the fact that persons in the institutions would be closer to the source of impacts for longer continuous periods and would be exposed to a higher degree of impact at any given time. Concern about the effects on these populations served in part to motivate the MWRA to analyze in more detail the "footprints" that could be accommodated on Long Island and on Deer Island and the need for and feasibility of mitigative design concepts, buffers, and/or the relocation of the respective institutions. Also considered was the exposure to impacts over a longer period of time as would be the case for most of the residential neighbors.

Traffic. Traffic access roads were reviewed for capacity and for anticipated peak and average use with and without the utilization of barging and busing. The MWRA learned that the greatest numbers of persons would be affected along the Winthrop access routes, but that a substantial number of persons would be affected along the East Squantum access routes as well. The fewest persons would be affected if the Quincy Shore Drive route to Long Island was available, but there were questions of implementability and structural feasibility that would have to be resolved in order to use that route. The degree of negative impact on the various roads was considered to be roughly the same for the various site alternatives.

A great deal of consideration was given to barging, with the recognition that it was required in order to sufficiently mitigate the traffic impacts that would be caused during construction. Implementability issues with regard to barging -- such as Coast Guard regulations and the construction of piers -- were explored, as were the costs of barging. A determination was made that the same requirements for barging applied to whichever site alternative was selected, and

therefore the concerns surrounding barging as a mitigation measure for the alleviation of traffic impacts on neighbors were found to be not site-determinative.

Also reviewed were the potential mitigation measures of ferrying workers to decrease traffic, and rehabilitating or replacing access bridges to accommodate heavy trucking. Implementing each of these measures appeared to pose a relatively similar degree of difficulty between sites and was not found to be an absolute deterrent. The cost of bridge repair or construction did differ between sites and was explored in greater detail by the MWRA in its concern for the issue of traffic impacts and the need to alleviate them. It was determined that it would be most costly to repair, replace or construct new bridges for access to Long Island.

Assuming a heavy reliance upon barging and taking into account the above factors, the MWRA concluded that the traffic impacts were significant but manageable with respect to all sites, and that this was not a site-determinative factor.

Noise. The information on noise contained in the SDEIS/DEIR was reviewed, and the concerns of the Town of Winthrop with respect to the adequacy of that information and the possible site-determinative nature of construction noise impacts were explored. Berms and temporary noise barriers were also discussed. The MWRA received a detailed letter from, and heard a presentation by, Winthrop's technical consultant. It further pursued additional noise information through the technical advisory group meetings and shared the ongoing work done by EPA's technical consultant. An update of this work was presented to MWRA by EPA shortly before MWRA's siting decision. The information on noise gathered and presented by EPA and adopted by MWRA for its tentative preferred alternative site selection indicated that although noise levels at Deer Island would result in greater impact to neighbors, particularly the close neighbors at the House of Correction, the level of construction noise at either site was at acceptable levels or could be sufficiently mitigated so that it was not a site-determinative issue.

Odor. The impact of odors, taking into consideration source, distance, population density, and potential for occurrence, was also evaluated. In addition to evaluating the effect of odors on nearby residences and the existing institutions, the MWRA considered the effect of odors on potential recreational users. It was determined that there might be intermittent effects on neighbors at either site with a potentially substantial effect on recreators at Long Island Head, given the seasonal wind patterns and projected siting plans.

The use of covered tanks to mitigate odors was explored. The MWRA balanced the mitigating effect of covered tanks against the operation and management difficulties that had been experienced at other plants utilizing covers and also considered the additional cost required to employ covered tanks.

After reviewing odors and their potential impact on any of the sites considered, the MWRA determined that odor control was a paramount concern in the design of the treatment plant and that stringent odor controls would be utilized no matter where the treatment plant was located. Having decided this, and having reviewed the odor impact information, the MWRA concluded that odor and its control posed somewhat different problems at each island but balanced out

sufficiently so as not to be a site-determinative issue between Long Island and Deer Island.

Odor impacts were found to have some significance, however, in the choice between all secondary options that retained the existing institutions and those secondary options featuring removal of the hospital or House of Correction. The options featuring retention of the existing institutions were considered less desirable because the ability to design the treatment plant with odor sources farther away from residential or recreational uses was substantially reduced at the more constrained sites. The retention of the institutions also increased the number of persons impacted and degree of severity of impact with respect to the persons living, working or staying in the institutions.

Visual Effects. It was determined that a treatment plant on either island would have a negative impact on persons in the existing institutions due to proximity. With respect to residential neighbors, it was determined that if the institutions remained, there would be a greater negative impact from a treatment plant on Deer Island. If the House of Correction were removed, however, modifying landforms and landscaping could be used to screen the treatment plant from most residences.

Property Values. The effect on property values of the construction and operation of the treatment plant was addressed. Comparisons of affected communities with respect to fair market value, past appreciation, turnover rates and anticipated changes due to treatment plant construction and operation were reviewed. It was generally concluded that, no matter which site option was selected, property values probably would not decline during successful plant operation. However, there was discussion that there may be a decline of property values for communities near the treatment plant during construction but that these values would likely rebound fully after completion of construction. Also discussed was a projected possibility that property values around Deer Island might not fully rebound after construction. However, it was also deemed possible that the substitution of a carefully constructed and well-run treatment plant on Deer Island might raise values in the neighboring communities higher than they would be with the continuation of the existing plant operation. On the whole, property value impacts were determined not to be site-determinative, but a matter to be addressed through mitigation once a site was selected.

Health and Safety. Health and safety concerns of the community -- such as traffic impacts on schools and the elderly, chlorine delivery, air quality reduction from traffic or the facility operation -- were examined and not found to be site-determinative factors.

Summary of Effects on Neighbors. Most of the effects considered within each of the above sub-categories of effects on neighbors were found to be roughly equivalent when applied to the various site options. Although there were perceived imbalances of effects under some of the sub-categories, imbalances against one site under one sub-category tended to be neutralized by imbalances against another site in another sub-category. For example, imbalances found against the use of Long Island for either all secondary or mixed alternatives due to the additional cost of the traffic mitigation measures of repairing or replacing access bridges tended to balance out against the additional cost that might be required for noise mitigation on Deer Island, particularly if the House of Correction was not removed.

Similarly, the imbalance against Long Island caused by the determination that more substantial odor effect was likely on potential recreators was balanced against the possibility for greater negative visual impacts on residential neighbors from a treatment plant on Deer Island if the House of Correction was not removed. In sum, when all the effects were weighed within the sub-categories and the total effects of each sub-category were weighed one against the other, the MWRA concluded that the criterion of effects on neighbors, as a whole, was not site-determinative.

Equitable Distribution of Regional Impacts

Equitable distribution of regional impacts was adopted by the MWRA as an additional criterion in response to the issues of fairness raised in the comments on the SDEIS/DEIR. The criterion brought into the decision process considerations of how many and what kind of impacts a community might already bear from proximity to regional facilities other than the contemplated treatment plant. For example, impacts on Winthrop from Logan Airport, the Deer Island House of Correction and the current Deer Island treatment plant were reviewed, as were the effects on Quincy of the existing Nut Island treatment plant and flight patterns from Logan Airport. Distinctions were made between regional uses that provide little benefit to the community impacted (such as Logan Airport vis-a-vis Winthrop) and those regional facilities which daily serve a number of residents of the impacted communities (such as MBTA stations in Quincy). It was further noted that the impact from the latter use was mitigated by the existence of a local-aid fund which provides some monetary reimbursement to host communities.

The consideration of regional use burdens on potentially impacted communities had two applications in the preferred alternative siting decision. First, there was an assessment of whether or not the cumulative regional burdens on any one particular community would be so excessive if the treatment plant were sited nearby as to require, without regard to any other criteria, that the treatment plant be sited elsewhere. One decision-maker concluded that the cumulative and long-term burdens imposed on Winthrop currently and in the past required a decision to site the treatment plant at a location other than Deer Island. Other decision-makers decided that the degree of unfairness did not rise to the level of unilaterally precluding the siting of the treatment plant on Deer Island.

The second way in which the criterion of equitable distribution of regional impacts was applied was to broaden the scope of factors to be considered in assessing effects on neighbors and in determining the nature and degree of mitigation measures to be undertaken. As to the former, the impacts of other regional uses were evaluated not only separately, for their effect on the community, but as they might combine with the noise, odor, and other impacts of the proposed treatment plant.

In assessing the impact of regional facilities on the various communities, the MWRA concluded that the choice of any of the alternative site options was unfair to whichever of the communities were impacted, by virtue of the burdens to be borne by those particular communities on behalf of so many other communities. When contrasting the relative regional burdens between the impacted communities, some decision makers noted that the greatest share of burdens for regional impacts was already borne by the City of Boston and that Boston's burdens would be

increased whichever option was chosen. Between the City of Quincy and the Town of Winthrop. the MWRA concluded that the greater number of regional burdens borne by Winthrop made it more unfair to Winthrop to locate the plant on Deer Island than it was unfair to Quincy to locate the treatment plant on Long Island.

Cost

From the outset of its deliberations. the MWRA considered cost to be an important criterion. One of the first tasks the MWRA undertook was to closely examine the previous cost estimates which had been included in the 1982 MDC Site Option Study and the SDEIS/DEIR. Those cost estimates and a new set of estimates prepared by MWRA's consultant were analyzed and discussed both as to the absolute dollar figures presented and as to the relative differences in costs between sites.

Following the initial presentation to and discussion of these figures by the MWRA, consensus was reached by the various cost estimators which reduced the range of difference among them by half. The MWRA reviewed the original figures. the new figures, the basis for each and the rationale for the differences, It recognized that the figures could be firm to only a certain degree. given that a site was being selected prior to any facility design being undertaken. The MWRA chose to consider the higher figures in the range as better representing the most conservative case for design and construction needs and choices. including but not limited to greater assurances of reliability through increased redundancy and mechanical backup.

At each stage of development of the cost figures. the MWRA determined whether the differences changed the ranking or rating of the site alternatives or the relative differences between the alternatives appearing in the SDEIS/DEIR. As to the first two stages of development in cost estimates described above. the MWRA concluded that the ranking or rating of alternatives remained the same and the relative difference between the sites remained constant no matter which estimates at which level of refinement were used.

However, as the deliberations of the MWRA with respect to the other criteria continued, it became evident that cost was closely intertwined with assessments of those criteria and constituted an important factor for each item evaluated. As a result, further discussion and inquiry on costs were undertaken by the MWRA. and a third and more detailed cost analysis was produced. The resulting figures were reviewed and discussed by the MWRA. It was determined that while the new figures narrowed the difference in cost between some of the options involving Long Island and some of the options involving Deer Island, it did not change the ranking of any of the site alternatives.

The MWRA also developed and discussed a comparison of costs between Deer Island and Long Island with and without the existing institutions. The MWRA concluded that in all cases. it was less costly to construct the treatment plant on Deer Island as compared to constructing it on Long Island. It further determined that it was less costly to construct the treatment plant on either of the islands without the respective existing institutions being present.

Implementability

The MWRA utilized the implementability criterion to assess how quickly and how predictably the treatment plant could be completed at each of the alternative sites. This included a review of the requirements for and potential impediments to obtaining the real estate necessary for the construction of the treatment plant under the various alternatives. After examining the ownership and the means by which that ownership could be transferred, the MWRA concluded that obtaining the required land under all the options was roughly equal in terms of the legal steps to be taken and the likelihood of success.

The MWRA also reviewed the various permits, licenses and approvals that would be required from federal, state and local authorities in order to build the treatment plant under the various site plans proposed. It found that most of the state and federal permits required were equally applicable to Deer Island and to Long Island. It noted that burial grounds and archaeological/historical properties were a significant issue with respect to Long Island and would probably require extensive mitigation efforts, but also took into account that Deer Island had historic resources that might require consultation with authorities and possible mitigation. Similarly, the MWRA examined the conclusion of the SDEIS/DEIR that the permit issues surrounding burial grounds principally impacted Long Island, but also noted the possibility that they might be involved with Deer Island as well. With regard to the loss of historical or archaeological resources, the MWRA gave weight to the fact that the necessary consultation, mitigation and approval process for whichever island was selected could be engaged in concurrently with the facility planning and design process for the treatment plant, and would not greatly delay the construction of the facility. It was also considered important that this approval process, while requiring consultation and mitigation, could not prohibit the construction of a treatment plant on either island.

Further implementability issues that might apply to only one of the islands, or might be more difficult on one island as compared to the other, were examined. These included wetlands, order of Conditions, bridge construction, barrier beaches, opening of Shirley Gut, air quality questions, possibility of contaminated dredge spoils, existing grit and screenings, hospital relocation and House of Correction relocation. The first three of these issues were thought to have more certain application to Long Island but were considered to have possible application to Deer Island as well. The middle three issues were looked at as possibly raising additional or more difficult issues in the case of Deer Island. Air quality issues were discussed with EPA, and further information obtained by the EPA indicated to the MWRA that the treatment plant could be located at either island without violating national ambient air quality standards for air pollution under the configurations being considered by MWRA and by EPA.

Implementability of relocating the existing institutions on Deer Island and Long Island was scrutinized very closely by the MWRA. The MWRA heard and considered presentations by legal counsel to the City of Quincy and the Town of Winthrop on the need for and comparative legal difficulty of relocating the institutions. The MWRA also received and evaluated communications from the Governor of the Commonwealth, the Mayor of the City of Boston and the Speaker of the Massachusetts House of Representatives. The MWRA concluded that, as to real estate and permit approval issues, the various site options balanced out with respect to implementability. The

removal of the House of Correction from Deer Island, however, was felt by the MWRA to be more feasible than removal of the Long Island Hospital, considering the commitments made by the authorities who would be in a position to implement the respective relocations.

Reliability

The MWRA viewed reliability as the concept of enhancing the overall integrity of the waste treatment system. Information was received on such factors as minimization of detrimental consequences of outages, operational capabilities during and after construction, managerial enhancement and technological reliability. Particular issues of reliability were explored in more detail. The performance of a secondary treatment system was reviewed at some length with stress on the need for proper design to handle such things as variable loads and intake of septage to prevent a malfunctioning of the system which would result in partially treated sewage being released into the harbor through a short outfall. The reliability of tunnels was reviewed, and the use of round versus rectangular clarifiers was discussed. Also considered was the need for backup in the case of catastrophic outages.

With regard to clarifiers, the Board heard that circular clarifiers were considered more reliable by some and that use of those clarifiers would require a greater acreage and expenditure to install, but it also heard that a comparable degree of reliability could be provided by rectangular clarifiers, which use less space and are less costly. The MWRA determined that either type of clarifier could be utilized under the various site options being considered.

The greater or lesser use of tunnels under any particular site option was considered to be an insignificant factor since it was determined that reliability of tunnels could be assured through proper design and maintenance during construction and operation. There was a recognition that those site options with split plants would provide greater reliability in the case of catastrophic outages, but this fact was determined to be offset by the consideration that such outages could be expected to occur at very infrequent intervals and that the ability to achieve reliability at split plants would be more costly because of the need to provide two sets of administration and staffing.

In assessing the various site options in light of reliability factors, the MWRA concluded that, while reliability was a very important consideration in constructing and operating the wastewater treatment plant, it was not a determinative factor in selecting site options between Long Island and Deer Island. Reliability was viewed by the MWRA, however, as a very important factor in its relationship to impact on neighbors. Any reduction of efficiency or increase in operational malfunctions would potentially create greater negative impacts, such as odors, on the neighborhood. It was also recognized and considered an important factor that the capital cost of the secondary treatment plant would be greatly increased by the design and engineering which would be necessary to protect against the greater unreliability inherent in a constrained site. Also, higher operational and maintenance costs would have to be anticipated as a result of the more complex design that would be required.

Weighing all these factors, the MWRA concluded that greater reliability would be obtained in

any of the secondary treatment plant options if the respective existing institutions were removed and, conversely, that reliability would be severely impacted if the secondary treatment plant was built without removing the respective institutions. In any other regard, reliability was considered to be equally obtainable at all site alternatives considered and therefore not site-determinative.

Harbor Enhancement

The MWRA's view of harbor enhancement incorporated compatibility of the proposed treatment plant with attainment of the harbor's potential. The MWRA reviewed the site alternatives not only with respect to how each site option might serve as a source of impact on the harbor but also as to how each option might serve as an opportunity for achieving the objectives listed. This information for the site options -- as they related to one another and to the harbor as a whole -- was then considered.

Certain concerns of the MWRA were further explored. The potential for recreational use of Deer Island was reevaluated and discussed. As a result, the MWRA accorded greater weight to the recreational potential of Deer Island than had been previously assigned to it in the SDEIS/DEIR. The MWRA concluded that the recreational potential of Deer Island and of Long Island, absent any development, was similar in a number of ways with many of the same types of activities potentially available. Two differences were found to favor the preservation of Long Island's recreational potential, however. The first was the greater potential for public swimming beaches at Long Island. The second was the wilderness experience derived from the wild vegetation in the undeveloped parts of Long Island which, once destroyed, could not be recreated elsewhere.

The two islands were also reviewed for compatibility of recreational use with a treatment plant present. If the existing hospital were retained along with the treatment plant, Long Island would lose the significant recreational potential of Long Island head but might retain its barrier beaches, whereas if the existing House of Correction were retained, Deer Island might be able to encompass a small naturalized park located at Deer Island head. If neither existing institution remained along with the treatment plant, a park at Long Island head and an environmental study area in the southwest of long island could possibly be preserved, while at deer island, a neighborhood park and a regional park could be created and the natural beaches preserved.

It appeared to the MWRA that the quality of recreation on the islands -- co-existent with a treatment plant but without the existing institutions -- was higher for Deer Island than Long Island. At Deer Island, existing or man-made landforms could screen recreational areas from nearby receptors. At Long Island, the treatment plant would be highly visible, and the wind patterns might carry the odors over Long Island Head a significant amount of the time. In balance, the MWRA felt that greater recreational potential for the harbor would be available by building the treatment plant on Deer Island rather than Long Island with or without the existing institutions, but particularly in the latter case.

The MWRA also considered implementability of recreational plans. It was noted that Long Island

was physically ready to be developed for recreational use almost immediately if no treatment plant were sited there, but that a much longer time would elapse if recreational use had to wait until a treatment plant was operational on Long Island and the Deer Island treatment plant subsequently removed. The availability of funds for recreational development of Long Island as an already established priority in the Boston Harbor Islands Park system enhanced the likelihood of recreational development of Long Island in the near future.

In assessing the visual effect of the various treatment plant site options, it was determined that the primary and secondary treatment plant options at Long Island were deemed to produce the most radical changes to the natural terrain and to impact the most negatively on the harbor as a whole.

Having reached the above conclusions and having evaluated the information contained in the SDEIS/DEIR, the MWRA concluded that harbor enhancement would be promoted by the preservation of Long Island as a potential park resource and, conversely, that the harbor would be diminished both visually and for recreational purposes, if the treatment plant were constructed on Long Island.

Effect on Natural and Cultural Resources

The MWRA examined the natural and cultural resources that would be impacted by each of the site option alternatives. In addition to the information contained in the SDEIS/DEIR, summaries further distilling the information and updated reports of ongoing evaluations of the sites by the Massachusetts Historical Commission were heard and evaluated. The MWRA not only considered the number and significance of historical, cultural and archaeological structures and sites, but also the degree of mitigation that might be required if such places and things were disturbed. The possible effect of any mitigation measures on duration and cost of construction was then assessed. The MWRA also gave some weight to the nomination or intended nomination of those items to the National Register of Historic Places.

The MWRA took into account the number of archaeological sites in existence, the rarity and integrity of such sites, the contribution of such sites to an understanding of our history, and the quantity of material contained in the sites. It was noted that no archaeological sites had been uncovered at Deer Island, but the MWRA also took into account that there had not been as thorough a survey of parts of Deer Island as there had been for the whole of Long Island. Nevertheless, in reviewing the five prehistoric sites uncovered at Long Island, the MWRA determined that their preservation deserved stronger consideration in the choice of a site.

With regard to cemeteries, the MWRA contrasted the existence of several cemeteries on Long Island with the possible existence of a cemetery on Deer Island. Again, however, it noted that Deer Island had not been as intensively surveyed as Long Island. It noted that Long Island in its entirety was being considered for nomination as part of the Boston Harbor Archaeological District. The MWRA concluded that the existence of cemeteries was not as significant as the existence of archaeological sites since the cemeteries could be moved and preserved elsewhere. Although the movement of graves raised implementation issues, those issues were the same for each island and were not considered to be impossible to overcome.

The MWRA also reviewed the potential eligibility of the Long Island Hospital, the Deer Island House of Correction, and the Deer Island pumping station for listing on the National Register of Historic Places.

Lastly, the MWRA reviewed the natural resources of the two islands. While little or no adverse impacts to the natural resources on Deer Island were found, with the exception of the removal of the drumlin on Deer Island in the case of a secondary treatment plant being sited there, it was determined that the wetlands and barrier beach at Long Island might be adversely affected by the construction of either a primary or secondary treatment plant even if strict controls were imposed. Concern was expressed that even a split secondary option would impact on sensitive areas on Long Island. In sum, the MWRA concluded that the least negative impact on natural resources would be achieved by selecting Deer Island for an all-secondary or all-primary wastewater treatment plant.

Mitigation Measures

The MWRA used the criterion of mitigation measures to focus on and clearly consider those actions which might be or ought to be taken with regard to a particular site to make that siting choice environmentally acceptable, and to assure to the greatest extent feasible that negative impacts from the siting selection would be alleviated or compensated for. The MWRA considered both environmental and non-environmental measures.

Environmental Mitigation. Environmental mitigation measures were considered to be those steps which would minimize adverse impacts from the construction and operation of the treatment plant.

Construction impact mitigation measures reviewed included barging, land modifications and buffers, scheduling and specifications for equipment to reduce noise impact, and monitoring and response mechanisms to oversee and enforce construction mitigation efforts.

Operations impact mitigation measures examined included the use of technology, design and buffers to reduce noise, odors and visual impacts on residences, institutions and/or recreators, as well as adaptation of site layouts and monitoring mechanisms to ensure proper operation and maintenance of the treatment plant and to assure responsiveness to changing conditions.

Most of the environmental mitigation measures were explored not only separately but as part of discussions involving reliability, effect on neighbors, cost, site layouts and effect on natural and cultural resources and are addressed to varying degrees under each of those topics in the FEIR. The MWRA articulated throughout these discussions a strong commitment to environmental mitigation, particularly as it would reduce negative impacts on the nearby receptors. It also recognized, however, that the extent of the mitigation employed would be determined, in part, by balancing the cost to the ratepayers against the degree of mitigation to be achieved. In some cases a determination was made that certain amounts or kinds of mitigation would be undertaken regardless of cost. For example, it was decided that stringent odor controls would be employed no matter where the treatment plant was constructed. It was

also determined that a significant degree of barging was required for the transportation of construction equipment and materials.

Most of the environmental impact measures considered were deemed applicable in some degree to all sites, but some measures were found to be required more frequently or to a greater degree under one site option or another. For example, the environmental mitigation measures to be employed when disturbing cultural or natural resources were perceived to be required more often and to entail more effort at Long Island than at Deer Island due to the greater number and value of sites located at Long Island. Balanced against this was the greater impact of noise on Deer Island neighbors and the resulting need for additional mitigative measures. The MWRA concluded that the individual environmental mitigation measures or the degree to which those measures might need to be applied differed from site option to site option but that, when all the mitigation measures for a particular site were totaled and balanced against all the mitigation measures required for another site selection, the environmental mitigation measures tended with one exception to balance out and not to be site-determinative. The exception pertained to the split plant options which would require the implementation of mitigation measures at two sites instead of one, with a substantial increase in cost. The MWRA considered this a factor to be weighed against selection of the split plant options.

The MWRA did decide that mitigation measures, while not being site-determinative between all Deer Island and all Long Island, were of critical importance with respect to whichever site it chose. Consequently, MWRA voted just prior to selecting its tentative preferred alternative site, that its FEIR for siting the Harbor Islands treatment plant should include a complete discussion of all practicable means and measures to minimize damage to the environment in connection with construction of the new sewage treatment facility including but not limited to (i) barging of construction material and personnel, (ii) limitations on unnecessary construction period traffic, (iii) controls on construction noise, (iv) controls on operating noise and odors, (v) visual enhancements of the site, (vi) alternatives to through-neighborhood trucking of chlorine for purposes of facility operations, (vii) construction of deep ocean outfalls, and (viii) development of compatible recreational uses on the site and elsewhere in Boston Harbor. The Board also voted on the day it made its tentative preferred alternative selection that it preferred that sludge management facilities be located off-site from the treatment facility.

Non-Environmental Mitigation. The MWRA considered non-environmental mitigation to be an important consideration in the siting decision and a necessary adjunct to the construction of a treatment plant of the size and complexity planned. Non-environmental mitigation measures examined were the opening of Shirley Gut, which would physically isolate Deer Island from the mainland, rehabilitating or reconstructing access bridges, development of recreational or other multi-use possibilities for the sites considered, protection against future facility overload, assurances of plant operating performance, employment of innovative technology, and relocation of the existing institutions. With respect to the measures reviewed, the ones determined to be site-specific were those concerning access bridges, opening of Shirley Gut, and relocation of the existing institutions.

As discussed in the text regarding the criterion of effect on neighbors, the MWRA evaluated the

comparative difficulty and cost regarding rehabilitation or replacement of access bridges and determined that it would be more costly to repair, replace or construct new bridges for access to Long Island.

After examination of the geologic processes and currents affecting Shirley Gut, the need for and high cost of maintenance to keep the Gut cleared, the numbers of regulatory requirements for undertaking such a project and the possibility that its being opened would result in greater nearshore pollution and perhaps permit movement of polluted waters from Boston Harbor through the gut to the eastern shores of Point Shirley and Winthrop, the MWRA determined that the opening of Shirley Gut was not a feasible mitigation measure and that other means of separating Deer Island from the mainland should be considered if a need for separation were determined necessary or desirable.

The relocation of the existing institutions was determined by the MWRA to be a critical non-environmental mitigation measure. This conclusion resulted from the MWRA's evaluation of: the effects of noise, odor and visual aspects of the treatment plant on the persons working in or inhabiting the institutions; the reduction in reliability which would result from construction of the treatment plant on sites constrained by the presence of the institutions; the far greater construction cost and ongoing maintenance and operational costs which would result from having to construct the treatment plant on a constrained site; and the greater recreational potential which would be available for the harbor if the institutions were removed. With respect to cost, recreational potential and the effects of noise, the MWRA concluded that it was even more important to relocate the House of Correction than the Long Island hospital, since the negative impact from retaining the existing institution on the same site as the treatment plant was greater for Deer Island than for Long Island. The MWRA also determined that while regional impacts would be more equitably distributed by the relocation of either institution, more equitable distribution would result from the relocation of the House of Correction due to the nature of the respective institutions and the number and kinds of regional impacts already experienced by the Town of Winthrop. The MWRA further noted that property values were more likely to be increased in the Town of Winthrop by the removal of the House of Correction than those in the City of Quincy by the removal of the hospital, and that the health and safety of residents of the Town of Winthrop were apt to benefit by the relocation of the House of Correction.

In sum, the MWRA concluded that if either Long Island or Deer Island were selected, the existing institutions should be relocated. As between the two islands, the MWRA decided that it was more important and more beneficial to remove the House of Correction if Deer Island were selected than it was to relocate the hospital if Long Island were selected. Some decision makers felt that if Deer Island were selected, the House of Correction must be relocated. For these decision makers, the relocation of the House of Correction was not a mitigation matter but an action compelled by the other criteria.

In evaluating the removal of the institutions, the MWRA placed strong emphasis on the implementability of such a measure. It received and considered commitments made by those authorities empowered to and responsible for any such relocation and determined that the implementability of relocating Deer Island House of Correction was extremely likely -- far more

likely than relocating the hospital.

As with environmental mitigation, the MWRA indicated its strong commitment to non-environmental mitigation by voting for the preparation of a complete discussion, for use by the Board of Directors, of proposed non-environmental mitigation measures for the construction of the Harbor Islands treatment plant including, but not limited to, construction workforce hiring preferences for residents of impacted communities, protection against diminished real estate values from nearby construction activities, preferential economic considerations for impacted communities, and funding for repair of bridges, roads or other physical infrastructure damaged by construction activities.

Criteria Weighing Process

The MWRA concluded that while all the criteria were important, some criteria were of relative equivalent value when applied to the various site options and were not site-determinative. Those criteria were: reliability, effects on neighbors, and implementability, as well as the environmental mitigation part of mitigation measures.

The five criteria which the MWRA concluded were site-determinative were: cost, equitable distribution of regional impacts, harbor enhancement, effect on natural and cultural resources, and non-environmental mitigation. All the site-determinative criteria except equitable distribution of regional impacts weighed in favor of selecting Deer Island as the site for the wastewater treatment plant. While the considerations of fairness implicit in the equitable distribution of regional impacts were valued very highly by the MWRA, they were not sufficient, by themselves, to outweigh the considerations of cost, harbor enhancement, effect on natural and cultural resources, and non-environmental mitigation measures.

In addition to determining which island should be the site for the construction of the Harbor Islands wastewater treatment plant, the MWRA concluded that whichever island was chosen, any existing institutions on that island should be removed. It based that conclusion on the results of applying the criteria of reliability, cost, harbor enhancement, effects on neighbors, and mitigation measures. Furthermore, the MWRA found on the basis of cost, equitable distribution of regional impacts, effects on neighbors (health and safety)*, harbor enhancement, implementability, and mitigation measures (non-environmental) that Deer Island without the House of Correction was the best site configuration considered. For some decision-makers, these latter criteria compelled the conclusion that if Deer Island were to be chosen as the site for the treatment plant, the House of Correction had to be removed.

* While health and safety issues originating from the construction and operation of a wastewater treatment plant were found not to be site-determinative, health and safety were considered to be enhanced by the removal of the House of Correction.

Tentative Selection

On July 9, 1985, on the day prior to its selection of a preferred alternative site, the MWRA voted its determination that the cost of a new wastewater treatment facility would be enhanced if the facility could be constructed on a site unrestricted by another existing institution, and that the removal of any existing conflicting institution would effectively serve to mitigate the impact of the location of a new wastewater treatment facility on surrounding communities.

In addition, the MWRA voted to direct its staff to work with any and all elected or appointed officials for the purpose of expediting the removal and relocation of any other institution located on whichever island it ultimately designated as the preferred alternative site for the new wastewater treatment facility. It further instructed its interim Executive Director to take certain actions to implement its position.

On July 10, 1985, the Board of Directors of the Massachusetts Water Resources Authority, in two separate votes, each ten to one, designated Deer Island as its preferred alternative for the siting of a new primary treatment wastewater treatment facility and as its preferred alternative for the siting of a new secondary treatment wastewater facility for Boston Harbor. The designations were explicitly undertaken for the purpose of completing final environmental and other precommencement review and to serve as the basis for undertaking only such additional work in the nature of planning, design, site assembly and any other work as can be accomplished prior to the availability of the Final Environmental Impact Report.

Final Selection

The following is the text of G.L.C. 30 Section 61, Findings by the MWRA on the Selection of Deer Island as the Site for Wastewater Treatment Facilities in Boston Harbor.

> On February 3, 1986, the MWRA made its final selection of a site for the proposed harbor island wastewater treatment plant. The selection of Deer Island as the location for the new facility brought to a close eight years of evaluation, discussion, comment and refinement of siting issues. Most of the history of the process followed and information explored is contained in the Supplemental Draft Environmental Impact Statement/Draft Environmental Impact Report (SDEIS/DEIR) and the MWRA's Final Environmental Impact Report on the Siting of Wastewater Treatment Facilities in Boston Harbor (FEIR).
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> In particular, the latter document details the decision process engaged in by the MWRA from its inception in early 1985 through to its tentative selection of Deer Island as the site for the wastewater treatment facilities in July, 1985. Since July, the MWRA has continued to gather information which it has published in the FEIR, has received and evaluated comments to the FEIR including the Secretary's Certificate of Adequacy, and has reviewed EPA's Final Environmental Impact Statement and comments submitted on that document. Based on this information and on its previous examinations and evaluation, the MWRA has made its final selection. The following

sets forth the findings upon which that final site selection rests and the process by which it was completed.

DECISION PROCESS

In addition to its prior deliberations leading to the tentative selection of Deer Island as a site for the harbor island treatment plant, the MWRA evaluated two new categories of information in making its final siting selection. The first, technical information collected or refined between the July 1985, decision and the publication of the FEIR, was presented to and discussed by the MWRA Board of Directors at a series of public board meetings held throughout the fall of 1985. During these meetings, the MWRA reviewed and approved the content of the FEIR and adopted commitments to major mitigation measures contained in that document.

The second category of information reviewed by the MWRA was public and official comment to the FEIR, including the Certificate of Adequacy issued by the Secretary of the Executive Office of Environmental Affairs. In addition, the MWRA staff reviewed the Environmental Impact Statement issued by the Environmental Protection Agency and the Board of Directors reviewed the comments to that document as well as a summary of relevant distinctions between the FEIS and FEIR.

The information thus gathered was then evaluated for its applicability to the method of decision-making to be used in the final selection, for the effect of the information on the application of decision criteria to site options and for its effect on the mitigation measures to be adopted by the MWRA. A summary of that evaluation follows.

DECISION-MAKING METHOD

Selection of Criteria

The MWRA chose to maintain the eight criteria utilized in its tentative site selection process: Reliability, implementability, harbor enhancement, impacts on cultural and natural resources, costs, effects on neighbors, mitigation and equitable distribution of regional responsibilities. These criteria had been selected originally by the MWRA in response to the decision process carried out through the SDEIS/DEIR and the comments on that process. The Secretary of Environmental Affairs ("Secretary"), in his Certificate of Adequacy on the FEIR ("Certificate") approved the use of Equitable Distribution of Regional Responsibility as a means of assessing the more emotional, unquantifiable aspects of siting but opined that mitigation was better addressed only after a siting selection and not as a part of the siting decision process. As to the latter, the MWRA found that the use of mitigation as a criterion in arriving at a site selection had served a useful purpose and had contributed a focus different from the discussion of mitigation after a site was selected and that it was better to continue the decision process as already begun rather than making a major shift in the use of criteria at the culminating point in the decision process.

Weighing of Criteria

The Secretary's Certificate on the FEIR had recommended that each criterion be assigned a relative importance in the final decision. The MWRA reviewed the eight criteria selected and determined that they should be given equal weight as compared to each other.

Site Options

The MWRA, in reviewing the information gathered in light of the criteria utilized, found that a number of earlier determinations made in its tentative decision process should remain intact. Some of these determinations, once confirmed, served to eliminate certain site alternatives from consideration. For example, the MWRA confirmed its earlier tentative site decision that Nut Island was unacceptable for the construction of a treatment plant of the size contemplated, particularly with the filling of Quincy Bay which would be required. The Secretary's Certificate had acknowledged and found this conclusion to be acceptable, and other comments had only served to support this position.

The MWRA also confirmed its tentative decision that the four split plant options be rejected on the grounds that only the criteria of reliability and equitable distribution of regional impacts favored the selection of any of the split plant options, while the concerns encompassed in the remaining criteria were adversely affected by those alternatives. For example, the split island options would be more costly to construct, operate and maintain; would cause aggravated impacts to a wider universe of neighbors -- thus causing the need for greater mitigation; would be more difficult to implement because of the need to obtain approximately twice as many permits; and did not significantly lessen the impact of single island alternatives on cultural or natural resources or harbor enhancement. There was no additional or different information presented to persuade the MWRA to change this position.

As a result of these findings concerning site alternatives, the MWRA was left with a comparison of all Long Island and all Deer Island as possible sites for the harbor facility. A summary of the analysis of these two site alternatives in light of each of the criteria used and the information gathered as it affected those criteria, and the conclusions reached, follows.

APPLICATION OF DECISION CRITERIA TO THE ALL LONG ISLAND AND ALL DEER ISLAND SITE ALTERNATIVES

CRITERIA WITH NO SITE DETERMINATIVE EFFECT

In examining Long Island and Deer Island in light of the eight criteria, the MWRA found two criteria, reliability and effects on neighbors, to be of relatively equivalent value and therefore not to be site determinative.

Reliability

The MWRA had previously found reliability to be non-site determinative in its tentative decision because the size and configuration of each of the islands presented the same potential for use of design and layout to provide for reliability of the waste treatment system. The MWRA, in its current evaluation on reliability, noted that no new information had been presented to change that determination and confirmed its earlier decision.

Effects on Neighbors

The MWRA also found the effects on neighbors to be roughly equivalent between the two islands. As before, effects on neighbors were reviewed in six components: traffic impacts, noise impacts; odor impacts; visual impacts; property value impacts and safety impacts.

Traffic

Following its initial determination that the traffic impacts were comparable between the two sites, the MWRA commissioned a study to augment information provided in the SDEIS/DEIR traffic analysis. This analysis examined roadway conditions, assembled traffic counts, determined the present level of service on the roadways (LOS), and evaluated the impact of expected construction traffic. The MWRA concluded that for the predicted level of construction related traffic there was sufficient roadway capacity leading to each site during peak hours and that the impact although somewhat worse at some intersections for access to Long Island, was relatively comparable.

The MWRA also further explored the feasibility of barging, identifying the types of barging and/or water transportation that might be needed and sites that could be utilized. The MWRA made commitments to a level of barging, to caps on construction-related traffic and to busing of workers, all of which is set out in the Commitments to Mitigation section below.

The MWRA reviewed traffic-related comments received on the FEIR. The MWRA concluded, based on its original evaluation and the additional traffic information and comments collected since its tentative decision and its strong commitment to mitigation measures, that the traffic impacts remained roughly equal and did not favor either island.

Noise

The MWRA, in its tentative decision, adopted the then current position of EPA that noise levels at Deer Island would result in greater impact to neighbors, particularly the close neighbors at the House of Correction. However, that position was predicated on EPA's view that Long Island as a site for the treatment plant could not contain the Long Island hospital whereas the Deer Island site could encompass the House of Correction.

The MWRA in its final selection compared the sites equally, i.e. both sites with existing

institutions and both sites without those institutions. The MWRA concluded that when the sites without institutions were compared, there was more noise impact on neighbors at Deer Island than at Long Island. If the sites were compared with the institutions present, then the severity of impact on the residents or workers at each institution was equivalent.

To explore whether noise levels at Deer Island could be kept at acceptable levels, the MWRA retained an acoustical consultant to evaluate expected noise levels during both construction and plant operation for the Deer Island site. The consultant also furnished information to the Board on existing acoustical conditions, applicable regulations and an evaluation of the expected effectiveness of noise mitigation measures.

The MWRA concluded that for the nearest residence the noise levels from both construction and operation were within applicable legal standards. Furthermore, during the daytime the projected noise would be indistinguishable as compared to the existing ambient levels. At night, with a minimum of construction to be anticipated, nighttime noise would not be an impact. During plant operation, if power was generated on-site, a slight increase in background levels over existing levels was determined to be likely.

Based on this information and upon review and assessment of comments on noise, the MWRA concluded that while noise impacts upon receptors other than the current institutions would be greater at Deer Island, those impacts could be maintained at acceptable levels. The MWRA also found that the noise impacts at Deer Island prison or Long Island Hospital, because of the proximity of those institutions, would raise the noise levels above the legal standard and would require extraordinary mitigation measures to be adopted.

Odor

Odor studies conducted on behalf of the EPA have indicated that potential odor impacts on neighbors are comparable, regardless of plant location. This confirmed the MWRA's tentative decision that the issue of odor was not site determinative. The MWRA further recognized that odor control was a paramount concern and that stringent odor controls would be utilized no matter where the treatment plant was located. As a result of further work presented since its tentative selection, the MWRA concluded that control stystems such as wet scrubbers and carbon absorption columns would likely be effective in controlling the odors. The MWRA confirmed its tentative decision that odor impacts were not site determinative and committed itself to a limit of no detectable odor off-site as well as a goal of no objectionable odor on-site.

Property Values

Reviewing trends in real estate values and the impacts of other noxious facilities on property values, the MWRA confirmed its tentative decision that the effect on property values, to the extent that that effect could be predicted, was not site-determinative.

Visual Impacts

In its tentative decision the MWRA determined that a treatment plant on either island have a negative impact on persons in the existing institutions due to proximity. With respect to residential neighbors, it was determined that if the institutions remained, there would be a somewhat greater negative impact from a treatment plant on Deer Island. If the House of Correction were removed, however, modifying land forms and landscaping could be used to screen the treatment plant from most residences.

Health and Safety

Health and safety concerns of the community -- such as traffic impacts on schools and the elderly, chlorine delivery, air quality reduction from traffic or the facility operation -- were examined and found once again not to be site-determinative factors.

Summary of the Effects on Neighbors

Most of the effects considered within each of the subcategories of effects on neighbors were found to be roughly equivalent between Long Island and Deer Island. For those two categories in which a somewhat more negative impact was discerned for Deer Island, noise and visual impact, the degree of difference in impact was not sufficient to change the balance of effects on neighbors between the two sites.

SITE DETERMINATIVE CRITERIA

The MWRA found the remaining six criteria to have a site-determinative effect. Five of the criteria favored the selection of Deer Island while one criterion, equitable distribution of regional responsibilities, favored the selection of Long Island. A summary of that analysis follows.

Equitable Distribution of Regional Responsibility

Just as in its tentative decision, the MWRA found in its final site selection that this criterion favored the selection of Long Island over Deer Island. The impacts of other regional uses such as Logan Airport, Deer Island House of Correction and the current Deer Island treatment plant were found to have greater impact on Deer Island neighbors than the airport and other regional facilities had on Long Island neighbors. The MWRA concluded that it was more unfair to site the harbor facility at Deer Island.

Cost

The MWRA again found this criterion to favor selection of Deer Island. There was no change to the cost information upon which the MWRA had made its tentative decision. Those figures still showed the construction of a treatment plant on Deer Island to be less costly than a facility at Long Island. While noting that EPA had found this criterion to

be non-site determinative and that the Town of Winthrop had concurred with this conclusion. the MWRA recognized that this reflected a value judgment by the EPA and Winthrop of the relative unimportance of the dollar difference which both EPA and MWRA agreed existed rather than different information as to the cost figures themselves. The MWRA. as the operator of the system felt that the difference in cost between the two sites was of site significant importance.

Implementability

In its tentative decision. the MWRA found implementability to be non-site determinative. The information which the MWRA had reviewed at that time covered the permitting and land acquisition issues and. based on the assessment that the numbers and types and timing considerations of permits and approvals were generally the same. had concluded that the criterion was relatively equivalent between the sites. The MWRA also noted at that time that the removal of the House of Correction from Deer Island was far more implementable than the removal of the hospital from Long Island due to the expressed support for the former by those in a position to effect the removal.

Two factors have been added to the implementability discussion since the tentative decision. however. which have caused the MWRA to change its conclusion about this criterion. The first is the concurrence in the approval by the Secretary of the selection of Deer Island as the site for the treatment plant. The second is the selection of Deer Island by the EPA as its preferred alternative. The choice of Deer Island as the preferred site by both a state regulator and a federal regulator. each of which has responsibilities in further permitting or approvals concerning the construction and operation of the treatment plant and related facilities. increased the likelihood of successful and expeditious processing of the many regulatory reviews and permits pertaining to the Deer Island site. It also suggests a facilitating of the disposition of federal land located on Deer Island. In light of these factors. the MWRA has found in its final siting decision that implementability is no longer non-site determinative and that it weighs in favor of selecting Deer Island.

Harbor Enhancement

A further exploration into recreational potential of Deer Island conducted during the tentative decision process was completed for the FEIR and confirmed what had already been suggested during the tentative decision process: that a greater potential existed for Deer Island than had been suggested in the SDEIS/DEIR. However. the possibility of this greater potential had been discussed when the MWRA made its tentative selection and its confirmation did not change the MWRA's determination that harbor/enhancement favored siting the treatment plant at Deer Island. The MWRA still found that Long Island's recreational resources included natural and undeveloped aspects which could not be recreated if lost; that Long Island as a park could be brought to reality sooner since it did not have sited on it both a prison and a current treatment plant which had to continue operating until the new plant was on line; that there were indications that official support and dollars had already been or could readily be mobilized to make a park on Long

Island a reality; and, finally, that the adverse visual impact on the harbor was greater from a treatment plant on Long Island because of the Island's position in the harbor and its configuration.

Effect on Natural and Cultural Resources

In examining the natural and cultural resources of each island, the MWRA took into consideration additional pieces of information received since its tentative decision. In particular, the MWRA considered the results of a study, which it had commissioned, of parts of Deer Island which had never been adequately evaluated before for the existence of archaeological or historical resources. That study confirmed the existence of a cementery in the northeastern part of the island and also confirmed the potential eligibility of the Deer Island pump station and portions of the Deer Island House of Correction complex for nomination to the National Register. Subsequently, the Massachusetts Historical Commission found that the pump station, and two buildings in the prison complex met National Register criteria. In its comments on the FEIS, the Commission also noted that Long Island in its entirety had been nominated to the National Register as a component of the Boston Harbor Islands Archaeological District, that the Long Island hospital complex also met National Register criteria of eligibility and that historic burial grounds existed on Long Island.

All the information received concerning these resources was a confirmation of material already considered to be potentially true during the MWRA's tentative decision. The MWRA found, as it had in its tentative selection, that Long Island possessed more resources and more unique resources than Deer Island and that these resources, particularly the unique resources, would be adversely impacted by the siting of the harbor treatment plant facility on Long Island.

The MWRA noted that EPA had found this criterion to be non-site determinative but recognized that EPA had hypothesized layouts which could avoid these resources without fully exploring the technical feasibility of those layouts. The MWRA had assured that the layouts upon which their conclusions rested were technically feasible.

Mitigation

The MWRA utilized the criterion of mitigation to focus on and clearly consider those actions which might be or ought to be taken with regard to a particular site to make it more acceptable. The utilization of this criterion in the siting decision process brought to the fore and highlighted mitigation measures which might be site specific and permitted the MWRA to weigh the need for those measures in its siting selection. Early analysis of mitigation needs during the decision process also laid the groundwork for a thorough understanding and appreciation of mitigation measures to be adopted once a site was chosen. The mitigation measures to which the MWRA finally committed itself in the implementation of its site selection of Deer Island are contained in the Commitments to Mitigation section which follows.

With respect to the effect of the mitigation criterion in the siting selection process, the MWRA confirmed its earlier finding that mitigation favored the selection of Deer Island.

While various measures to mitigate construction and operation impacts such as noise and odor or the destruction of natural or cultural resources might shift the balance slightly toward one site or the other within each of those categories, the total number of kinds and degree of mitigation required for one site or the other tended, with one exception, to balance out roughly equal as a whole. The one exception was the mitigation measure of relocating the existing institutions. The MWRA found in its tentative decision and confirmed in its final decision that it was critical to relocate whichever existing institution was located on the chosen site due to the adverse environmental effects which accrued from constructing the treatment plant on a constrained site in close proximity to the particular institution. However, the MWRA also found that there was more net benefit to building the treatment plant on Deer Island and removing the House of Correction than building on Long Island and removing the Long Island Hispital since removal of the House of Correction would favorably affect property values and the safety of the currounding community and would promote equitable distribution of regional facilities. Further details as to the findings of the MWRA regarding the removal of the existing institutions and the Deer Island House of Correction in particular is contained in the Commitments to Mitigation section which follows.

Final Siting Decision

Having found two criteria effectively neutral between Long Island and Deer Island (Reliability and Effects on Neighbors), one criterion favoring the selection of Long Island (Equitable Distribution of Regional Responsibility) and five criteria favoring selection of Deer Island (Cost, Implementability, Harbor Enhancement, Effects on Natural and Cultural Resources and Mitigation), and having given each criterion equal weight, the MWRA determined that the most appropriate site for the harbor island wastewater treatment facility is Deer Island.

COMMITMENTS TO MITIGATION

Recongizing the need to adopt all feasible measures to mitigate the adverse environmental impacts, the MWRA, as part of the FEIR, set forth a series of mitigation commitments designed to alleviate the impacts associated with the construction and operation of the Harbor Islands plant. During the process of making its final siting decision the MWRA reviewed the public comments on the proposed mitigation commitments and the comments received from the Secretary of Environmental Affairs and adopted a final series of mitigation commitments. This section sets out those commitments.

--Commitments on Flow and Growth
--Commitments on Plant Maintenance
--Commitments on Odor Control

--Commitments on Noise
--Commitments on Barging
--Commitments on the Use of Liquid Chlorine
--Commitments on the Relocation of the Deer Island House of Correction

Commitments on Flow and Growth

Recognizing the need for responsible management and being sensitive to the possible need for expansion of the proposed Harbor Islands treatment plant, the MWRA has made the following commitments with respect to flow and growth:

- The MWRA will undertake all necessary and prudent planning and management initiatives to avoid overloading the Harbor Islands treatment plant.

- The MWRA will not expand the treatment plant capacity unless or until it has implemented flow management techniques and has developed and implemented a program to avoid excess pollutant loading. These techniques and programs include:

    - Conducting infiltration/inflow reduction programs

    - Instituting water conservation programs that can reduce wastewater flows

    - Pricing of water and sewer services to promote the conservation of water, thus reducing wastewater flows

    - Controlling pollutant loads through pricing strategies and pretreatment programs

    - Controlling both flow and loads through regulatory controls, such as flow reduction programs to compensate for new connections

    - The MWRA will develop monitoring and triggering programs so that it will be able to test the effectiveness of the flow management techniques and to provide the MWRA with the ability to determine when planning for the MWRA's next increment of treatment capacity should be undertaken

- If the MWRA determines, through its monitoring and triggering programs, that the flows and loading are increasing at rates higher than projected in the FEIR, it will take all necessary steps to plan, design, and construct ancillary facilities including (but not limited to):

    - Flow control structures, such as on-line and off-line storage to minimize peak flows at the plant

    - Septage treatment facilities to reduce pollutant loadings on the Harbor Islands plant

- o If the ancillary facilities are insufficient to accommodate increased flow and loading and to prevent exceeding the design capacity of the Harbor Islands treatment plant, the MWRA will take all necessary steps to plan, design, and construct satellite treatment plants unless it determines it would be economically or environmentally infeasible to do so.

- o Notwithstanding the foregoing, the MWRA does not intend the adoption of the above commitments to require the postponement or cancellation of any capital program contained in the Authority's Fiscal Year 1986-88 capital budget that services to eliminate an existing problem of sewage backups.

The purpose of these commitments is to confirm the MWRA's desire to establish a sound and rational program for assessing future capacity needs, to respond to public concerns on overloading and future system expansion, and to provide a framework within which additional capacity will be planned.

Commitments to Operation and Maintenance

MWRA has already made clear its commitment to improved operations and maintenance by approving both a substantially increased operating budget and by authorizing significant increases in operations and maintenance staff for existing facilities. MWRA's commitment to maintenance is underscored by their adoption of the following assurances:

- o Review of Recurrent Budgets. Annual operating budgets will be carefully scrutinized to be certain that these budgets reflect not only a sound maintenance program for existing facilities but that the budgets reflect any new facilities expected to be in service during the budget year. The MWRA will link budget expenditures with performance indicators that reflect the efficiency and effectiveness of the maintenance programs.

- o Renewal/Replacement Expenditures. More than $100 million in construction projects have been initiated at the Nut Island and Deer Island treatment plants to replace much of the antiquated equipment at these plants. These upgraded programs are expected to be completed in 1989 and will contribute significantly to the reliability of the existing plant equipment. Capital budgets in future years will continue to reflect the important role that R/R plays in the maintenance of treatment facilities. The MWRA's maintenance procedures will be modified at an early date to incorporate record keeping procedures that will provide a rational basis for R/R investment in future years.

- o Review of Maintenance Procedures. Prior to the completion of the on-going upgrade program, the MWRA will initiate a review of its existing maintenance procedures. Strengthened maintenance procedures will be designed including an aggressive housekeeping and preventive maintenance program. These procedures will be amended as new treatment facilities are constructed.

- o Initiate Early Planning. To ensure that operations and maintenance considerations are included as an integral part of the planning for all new facilities, MWRA will require that the plant's facilities plan include a preliminary plan of operations. The preliminary plan of operations will identify the additional or unique O & M requirements of the recommended facilities, including staffing and special training needs, manuals, special tools and workshops, and estimated budget considerations. This preliminary plan of operations will provide MWRA with two to four years' lead time prior to completion of facilities to incorporate the maintenance requirements of new facilities into on-going maintenance programs.

- o Adoption of Performance Indicators. MWRA will adopt performance indicators into the agency's proposed management information systems that will permit the Authority to review on a regular basis the level-of-effort and the performance of the maintenance activities. Indicators such as plant performance, equipment availability, maintenance labor/expenditures, custodial inspection reports, spare parts inventory, and equipment age will be monitored to regularly examine the efficiency of the maintenance efforts. Additionally, the Authority will involve the community in reviewing maintenance programs to provide focus on issues of local importance.

Commitments on Odor Control

The MWRA commits to the construction of the treatment pant that will control odors so as to eliminate detectable odors off-site and to control odors as necessary to protect the public health. Furthermore, the MWRA commits to the control of odors so as to minimize, to the maximum extent feasible, objectionable odors on-site.

The type of odor control needed will be selected during the facility planning effort. Sampling of the odor potential characteristics of the influent wastewater will be conducted as part of the facilities planning to provide the necessary data to develop a program of source control and to size and select the odor control equipment.

The most reliable means of measuring odor performances is the human nose. In order to measure the plant odor performance, an odor panel will be created composed of individuals from the community as well as individuals from the MWRA. The panel will routinely monitor for odors to ensure that no objectionable odors are occurring off-site. The panel will also respond to odor complaints received by the plant, by assisting in the investigation of the odor and recommending odor control techniques.

Commitments on Noise Control

The MWRA is committed to complying with all the legal standards of both City of Boston noise control ordinance and the Department of Environmental Quality Engineering.

Because of the scale of the proposed plant, however, the MWRA is setting as a goal noise abatement that goes beyond simply adhering to the City of Boston code. The MWRA has

to define, by the FEIR, what noise levels may be achievable and will examine means of noise abatement throughout the planning, design and operation of the facility.

The MWRA further commits to the development of a program for avoiding adverse noise impacts, the components of which shall be resolved during facilities planning but which shall include the following:

- o The establishment of an Acoustical Review Board. The Acoustical Review Board will include representatives from the community as well as engineers and MWRA staff.

- o The use of available and feasible noise control techniques, which may include items such as the evaluation of the acoustical characteristics of operational equipment and flexible scheduling of construction activities to minimize noise.

- o The establishment of necessary training and hiring practices to assume the best possible control of noise impacts.

- o The involvement of the community in the development of noise control programs and the participation of community representatives in those programs.

Commitment on Barging and Busing

The determination that barging and busing are necessary is a direct consequence of the volume of traffic associated with the construction of the proposed facility and the limited capacity of roadways leading to the plant site. The Traffic section of the FEIR describes the capacity of the roadways. The commitment to barging, therefore, also requires a commitment to maximum traffic levels associated with the construction of the plant. Those traffic levels are defined for both the pier construction period and for the period thereafter.

Prior to construction of the piers, it is not feasible to barge materials to the site. Therefore, the MWRA has given a high priority to the identification of barge sites, design of pier facilities and construction of those piers. The Authority is engaged in the selection of a consultant for the necessary barge and pier facilities. The MWRA commits to limiting the trucking of materials for construction of the piers to a maximum of 20 trucks per day.

Upon completion of the pier facilities, the barging of almost all heavy construction equipment and materials is, based on the analyses conducted to date, an achievable level of barging. The level of commitment is conditioned, however, to allow for contingencies that may result from scheduling or operational problems. The extent of such contingency trucking, after the completion of the piers, will be limited to a service fleet of eight trucks. Also, in order to minimize impacts associated with commuting of construction workers to the plant site, the Authority has committed to the busing of all workers, using a maximum of 28 buses per day.

In addition, the Authority will undertake an evaluation of the practicality of providing ferries to transport construction workers to the job site.

Commitments on the Trucking of Liquid Chlorine

The MWRA has committed to cease the trucking of liquid chlorine through the streets of Winthrop as soon as possible when water access facilities become operable and the transport of alternate disinfectant or barging of liquid chlorine becomes feasible.

Commitment on Relocation of the Deer Island House of Correction

The MWRA has determined that the Deer Island House of Correction must be relocated from Deer Island by those parties with jurisdiction over its operation and that such relocation must be deemed a mandatory mitigation measure.

The MWRA's conclusion with respect to this mitigation measure is based on its findings throughout the tentative and final site decision process relative.to the environmental impacts resulting from the construction of the harbor island treatment plant on either island with the existing institutions present, and the benefit to be gained by the removal of the existing institution from the island selected as the site for the treatment plant. Many of those findings, as they relate to Deer Island were addressed by the Secretary in his Certificate as well as by numerous commentors to the FEIR, all of whom found the relocation of the prison to be a required mitigation measure. The MWRA's findings on benefits which would result from relocation of the prison are summarized as follows.

The MWRA found that the reliability of the treatment plant would be greatly enhanced by providing sufficient space for optional design. The converse was also found, that building on Deer Island with the treatment plant present would require a cramped design with reduced space between piping and flow controllers resulting in decreased uniformity of flow and reduced control over the treatment process. This, in turn, would increase the possibility of operational malfunctions or decrease the ability to monitor or redress such episodes, resulting in adverse impacts on neighbors of the treatment plant.

The MWRA also found that building the treatment plant in such close proximity to the prison would cause severe visual and noise impacts on the persons living and working in that institution. The noise impacts on the prison would be above the legal standard and would require extraordinary mitigation measures to be undertaken to ameliorate the effect. Mitigation measures, such as buffers or berms, would place additional area demands on an already constrained site. Other measures, such as timing and placement of construction and equipment could adversely impact the length of construction time. Removal of the prison would eliminate such impacts and the need for such mitigation measures.

Relocation of the prison would also reduce costs. The cost of constructing the treatment plant on a constrained site with the prison present, of operating and maintaining the plant under those conditions, and of providing the necessary mitigation measures to

alleviate the proximity of the treatment plant to the prison would be significantly greater than building without the prison.

Finally, additional benefits to recreators and to non-prison receptors would accrue from the removal of the prison. Those benefits would include alleviating the visual impact of the treatment plant on Winthrop receptors by providing space for screening and modifying landforms, providing space for recreational and open land use, reducing traffic on Winthrop's streets by the approximately 114 autos a day currently used at the prison, substantially alleviating the combined impact of regional facilities on the Town of Winthrop and by enhancing the safety of the community.

For all these reasons and the reasons cited by the Secretary, some of which are echoed by other commentors, the MWRA considers the removal of the Deer Island House of Correction to be essential to the expeditious construction of new treatment facilities.

Further Measures to be Examined

The commitments to mitigation listed above comport with all mitigation measures which would be required under the MEPA statute. In fact, in many instances, as noted by the Secretary in his certificate on the FEIR, the MWRA has addressed many issues to a far greater degree than was required and has made commitments in these areas accordingly.

Nevertheless, the Secretary, in his final Certificate, has made recommendations that certain measures be undertaken either sooner than might be required or with respect to current facilities as opposed to the new treatment plant which is the subject of the FEIR.

The MWRA considers these suggestions positive and worthy of serious review. It has directed staff to evaluate the Secretary's suggestions and to recommend within thirty to ninety days where, when and how they may be responded to and the nature of the recommended response. The suggestions by the Secretary include:

1. The "Sewer Bank" concept be further explored and feasible programs developed to eliminate excess flow and accommodate new connections.

2. Accommodate future growth within the service area through satellite plants.

3. Continued and strengthened programs to monitor flows to provide sound data to gauge the effects of flow management.

4. Implement odor panel and formal odor complaint response at existing facility.

5. Consider real time monitoring of odors, perhaps using hydrogen sulfide as an indicator.

6. Consider development and implementation of a monitoring program for VOCs and other air toxics in the wastewater stream and in the ambient air.

7. Recommend implementation of an acoustic Review Board to monitor and respond to noise complaints at existing facility; and supplement such a noise program now and at the new treatment plant with periodic noise monitoring.

Summary of Impacts and Findings of Limitation of Impacts

The MWRA finds that the environmental impacts resulting from the construction of the Boston Harbor wastewater treatment facility are those impacts as described in the Draft Environmental Impact Report. elaborated on and refined in the Final Environmental Impact Report and commented upon in these G.L.C. 30. Section 61 Findings.

The MWRA further finds that its selection of Deer Island as the site for the wastewater treatment facility, and its commitment to the mitigation measure set out in the Commitments to Mitigation section of these G.L.C. 30, Section 61 Findings constitute all feasible measures to avoid or minimize the environmental impacts described.

Record of Decision

The text of EPA Region I's Record of Decision on the Final Environmental Impact Statement Siting of Wastewater Treatment Facilities for Boston Harbor is as follows:

> The U.S. Enviromental Protection Agency (EPA) has prepared this document as its Record of Decision (ROD) for the Final Environmental Impact Statement (FEIS) on the siting of the Massachusetts Water Resources Authority (MWRA) wastewater treatment faciities which will abate the pollution of Boston Harbor.
>
> The MWRA has the responsibility of selecting the site for the wastewater treatment facilities. EPA's primary responsibilities are to conduct an evaluation of environmental acceptability under the National Environmental Policy Act (NEPA), provide federal financial assistance if available, and ensure rapid compliance with the Clean Water Act.
>
> EPA issued a Supplemental Draft EIS (SDEIS) in December, 1984 and a FEIS on December 2, 1985 on the siting of wastewater treatment facilities for Boston Harbor. These documents evaluated the environmental impacts of various site options for facilities to treat Greater Boston's wastewater in compliance with water pollution control laws. The SDEIS also served as a Draft Environmental Impact Report (DEIR) under the provisions of the Massachusetts Environmental Policy Act (MEPA) for the Metropolitan District Commission (MDC). Since publication of this joint document, the sewer functions of the MDC have been reorganized into the MWRA. The Board of Directors of the MWRA chose to follow an independent but parallel decision process and to publish a separate but concurrent Final Environmental Impact Report (FEIR) under state law.

Following the concurrent publication of EPA's FEIS and MWRA's FEIR, EPA and MWRA conducted joint public hearings before reaching their respective final decisions. Public hearings were held on January 13, 14 and 15, 1986 in Quincy, Boston and Winthrop. Oral and written comments were submitted during the comment period. The public comment period ended on January 21, 1986 for the FEIS and January 24, 1986 for the FEIR.

In February, 1986, the MWRA determined that "the most appropriate site for the harbor island wastewater treatment facility is Deer Island." This ROD identifies EPA's final decision on the siting issue. This ROD is being circulated to inform the public of this decision and to respond to the comments on the FEIS.

I. EPA's FINAL DECISION ON THE SITING OF SECONDARY WASTEWATER TREATMENT FACILITIES FOR BOSTON HARBOR

With the understanding that EPA will require the MWRA to carry out the program of specified mitigation measures identified on pages 52-55 of the FEIS, Volume I, EPA's decision is that its preferred alternative is the All Secondary Deer Island alternative set forth in the EIS and described below. All Secondary Long (without the hospital) is also environmentally acceptable and is preferred over Split Secondary Deer-Long (without the hospital). The only alternative which EPA finds unacceptable is Split Secondary Deer-Nut. The decision process and the program of required mitigation measures is described in more detail in Section III.

EPA's preferred alternative for secondary treatment, All Secondary Deer, would expand the existing primary wastewater treatment facility at Deer Island to a secondary treatment plant. It would reduce the existing primary treatment facilities at Nut Island to a small headworks. It would include construction of a major new pipeline or tunnel from Nut Island to Deer Island and of an effluent outfall to the east of Deer Island Light. The existing wastewater treatment facility on Deer Island would be increased from 26 acres to about 115-140 acres while on Nut Island the existing wastewater facility would be reduced from 12 acres to about 2 acres.

This alternative would commit almost all the land on Deer Island south of the existing prison to wastewater treatment and level the most prominent topographic features of the island. This alternative would also require the construction of a bulk materials loading pier(s) and roll-on roll-off facilities at the site, and associated terminal(s) on-shore.

The estimated construction cost of this alternative would be about $1.135 billion and its annual cost of operation, maintenance and replacement would be about $50 million. Costs, acreage requirements, exact plant layout and mitigation measures will be developed in greater detail during further facilities planning on the project.

The Benefits of Moving the Prison

The MWRA favors a variation of the All Secondary Deer Island alternative which assumes that the prison would be removed as a mitigation action, and that its site would be made available for the treatment plant. This variation would also use most of the Island but prison removal would reduce the impacts of the treatment plant in several ways:

1. It would remove the receptor population (the prison workers and inmates most affected by the plant's impacts, including noise and odor.
2. It would eliminate prison-related traffic, thus offsetting construction-related and operations traffic for the treatment plant.
3. It would improve the appearance of Deer Island by removing the prison buildings.
4. It would permit opportunities for sculpting the landscape to a more natural appearance and for screening the facility from both the harbor and Point Shirley and Cottage Hill in Winthrop.
5. It would increase the opportunity for buffering noise at Point Shirley by earthen barriers on prison property.
6. It would permit the retention of a portion of the Island's shoreline for buffering and recreation.
7. It would remove prison-related anxieties from Winthrop.
8. It would make more land available for the wastewater treatment facility, possibly making construction and maintenance easier.

This variation does not eliminate the need for any of the mitigating actions proposed for the All Secondary Deer Island alternative with the prison to remain, except for those intended to reduce impacts at the prison itself, e.g., a noise barrier.

However, the process required to release the Deer Island prison site for treatment plant use could be so lengthy as to delay or frustrate the construction of this variation of the All Secondary Deer Island alternative. EPA has long advocated removal of the prison if Deer Island is to be the treatment plant site, but EPA will not require removal of the prison as a grant condition. Implementation of secondary treatment is required by the Clean Water Act and cannot be made dependent upon removal of the prison if the site is acceptable.

This ROD concludes that in EPA's judgement the All Secondary Deer Island Alternative is its preferred alternative and can be implemented without unacceptable environmental

impacts even if the prison remains.*

II. SELECTION OF ALTERNATIVES FOR EVALUATION

Federal regulations require EPA, during environmental review, rigorously to explore all reasonable alternatives for the siting of wastewater treatment facilities for Boston Harbor. Most of the alternatives initially investigated were derived from the EPA's 1978 Draft Environmental Impact Statement (DEIS), which examined only secondary treatment options, and the MDC's 1982 Nut Island Site Options Study. The Site Options Study identified eleven alternatives (eight secondary and three primary treatment alternatives), including some previously examined in the DEIS. In September, 1983, EPA and the Commonwealth conducted two public scoping meetings to receive comments on these initial alternatives from the public and from federal, state and local officials. Upon completion of the joint scoping meetings, EPA selected eleven additional alternatives for analysis, for a total of twenty-two alternatives to be studied. These included twenty alternatives for treatment at Deer, Long, Nut, or man-made islands and two alternatives including sub-regional "satellite" plants. A complete discussion of the twenty-two initial primary and secondary alternatives appears in the SDEIS at Vol II, Section 12.12. Table I is a complete list of the twenty-two initial options.

[See Table 1 on page 39 of this document.]

III. DECISION PROCESS

To examine such a large number of alternatives, a screening process was developed jointly with the Commonwealth. Its objective was to narrow the number of alternatives being investigated and to eliminate those that clearly offered few benefits or had significant adverse impacts. This initial screening of alternatives is summarized here; it is described in detail the SDEIS. Each alternative's economic, social and environmental impacts were studied. In addition, their technical, legal, institutional and political problems were also analyzed. Specific criteria were developed for comparison and screening of the options.

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* The Clean Water Act requires that wastewater treatment plants be constructed which will provide "secondary" treatment unless EPA, under strict statutory guidance, grants a waiver, under Section 301(h) of the Clean Water Act, permitting a lesser "primary" degree of treatment with a deep ocean dicharge. EPA has twice denied the MDC/MWRA request for such a waiver but final rights of appeal have not expired. EPA believes it is highly unlikely any such appeal, even if pursued, would prevail on the merits, or that the discharge of primary effluent into Massachusetts Bay would ultimately be permitted over the opposition of the Governor and other officials. However, in the interest of completing the NEPA review, EPA has decided in this ROD to resolve the siting of a primary treatment plant as well. The decision is the All Primary Deer Island alternative.

TABLE I

LIST OF TWENTY-TWO INITIAL OPTIONS STUDIED IN THE SDEIS

Secondary Treatment Alternatives

1a.1 Secondary Treatment at Deer Island, Headworks at Nut Island with separate North and South System Secondary Treatment Processes.

1a.2 Secondary Treatment at Deer Island, Headworks at Nut Island with combined North and South System Secondary Treatment Processes.

1b.1 Secondary Treatment at Deer Island, Primary Treatment at Nut Island for South system, separate North and South System Secondary Treatment Processes.

1b.2 Secondary Treatment at Deer Island, Primary Treatment at Nut Island for South System, combined North and South System Secondary Treatment Processes.

1c Secondary Treatment at Deer Island for North System, Secondary Treatment at Nut Island for South System.

2a.1 Secondary Treatment at Deer Island for North System, Secondary Treatment at Long Island for South System, Headworks at Nut Island.

2a.2 Secondary Treatment at Deer Island for North System, Secondary Treatment at Long Island for South System, Primary Treatment at Nut Island.

2b.1 Headworks at Deer Island for North System, Headworks at Nut Island for South System, Consolidated Secondary Treatment at Long Island.

2b.2 Primary Treatment at Deer Island for North System, Primary at Nut Island, Consolidated Secondary Treatment at Long Island.

2b.3 Headworks at Nut Island, Primary Treatment at Deer Island for North System, Consolidated Secondary Treatment at Long Island.

3a Headworks at Deer and Nut Islands, Consolidated Secondary Treatment at Lovell's Island.

3b Headworks at Deer and Nut Islands, Consolidated Secondary Treatment at a new man-made island.

Primary Treatment Alternatives

4a.1 Primary Treatment of All System at Deer Island, Headworks at Nut Island. Local Outfalls.

4a.2 Primary Treatment of All System at Deer Island, Headworks at Nut Island, Deep Ocean Outfalls.

4b.1 Primary Treatment at Deer Island for North System, Primary Treatment at Nut Island for South System, Local Outfalls.

4b.2 Primary Treatment at Deer Island for North System. Primary Treatment at Nut Island for South System. Deep Ocean Outfalls.

5a.1 Primary Treatment at Deer Island for North System. Primary Treatment at Long Island for South System. Headworks at Nut Island. Local Outfalls.

5a.2 Primary Treatment at Deer Island for North System. Primary Treatment at Long Island for South System. Headworks at Nut Island. Deep-Ocean Outfalls.

5b.1 Headworks at Deer and Nut Islands. Consolidated Primary Treatment at Long Island. Local Outfalls.

5b.2 Headworks at Deer and Nut Islands. Consolidated Primary Treatment at Long Island. Deep-Ocean Outfalls.

Satellite options 1&2 - Satellite facilities for South System with discharge to Charles and Neponset Rivers. Satellite facilities for South System with wetlands discharge.

In screening the initial alternatives, it became clear that no alternative was without some potentially adverse impacts. Furthermore, no alternative satisfied all of the criteria used in the analysis. Considering the size and complexity of the project, virtually all alternatives were considered to have at least one or more drawbacks that limited their acceptability to some affected group(s).

The initial screening process concluded that of the twenty-two alternatives studied, four secondary treatment options and four primary options conformed to these criteria and warranted further investigation and more detailed study. These alternatives reflected different approaches to the siting requirements of the MDC system. The impacts of these options also varied in their respective advantages and disadvantages. The eight alternatives are identified below according to their abbreviated names used in the EIS. (Parenthetical references in Table I refer to the nomenclature used in the initial screening process.)

a. Secondary Treatment (Harbor Entrance Outfall) Alternatives:

1. All Secondary Deer Island (1a.2)
2. Split Secondary Deer Island and Nut Island (1b.2)
3. All Secondary Long Island (2b.1)
4. Split Secondary Deer Island and Long Island (2b.3)

b. Primary Treatment (Nine Mile Outfall) Alternatives:

1. All Primary Deer Island (4a.2)

2. Split Primary Deer Island and Nut Island (4b.2)

3. All Primary Long Island (5b.2)*

4. Split Primary Deer Island and Long Island (5a.2)

A detailed assessment of the impacts of these alternatives was provided in the SDEIS. Figure I shows the eight alternatives with their respective facilities and harbor locations.

During the further preparation of the SDEIS. relevant Massachusetts agencies and the EPA agreed that it was necessary to refine the decision process because of the complexity of the siting decision and the great number and variety of factors which must be taken into account by decision-makers. The first step was to re-analyze the various arguments and considerations that had been brought to bear on this controversial siting decision by all concerned parties in order to determine their disparate objectives. These objectives were used to develop a more precise set of decision criteria against which the remaining alternatives were to be evaluated. It was the goal of the SDEIS to make the list short, yet inclusive of all concerns that had been raised. Six decision criteria were identified. Each alternative was to be evaluated to determine the extent to which it:

1. is consistent with and, if possible, promotes the fulfillment of the promise of Boston Harbor. (Harbor Vision)

2. can be implemented in a timely and predictable manner. (Implementability)

3. minimizes the adverse impacts of the facility on neighbors, taking into consideration existing conditions, facility siting impacts and mitigation measures. (Effects on Neighbors)

4. minimizes the impacts of the facilities on natural and cultural resources. (Impact on Cultural and Natural Resources)

5. can be built and operated at a reasonable cost. (Cost)

6. maximizes the reliability of the entire treatment system. (Reliability)

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* Though the SDEIS/EIR suggested that one alternative, All Primary Long, should also be screened out and not receive further active consideration, the SDEIS/EIR and the FEIS contained a full evaluation of All Primary Long. EPA considers that all eight alternatives received an equal level of analysis.

Finally, EPA and the Commonwealth developed a comprehensive program of mandatory measures applicable to all alternatives: barging of materials, busing of workers, and noise and odor control.

Thus, in the SDEIS/EIR, EPA and the Commonwealth had narrowed the options remaining for secondary or primary treatment from twenty-two to eight alternatives, but had not arrived at a statement of two preferred alternatives, one for secondary treatment and one for primary treatment. The most important factor leading to this outcome was a desire on the part of both EPA and the Commonwealth to encourage public scrutiny and obtain formal public comment on the results of initial screening process, the large amount of new data, the new decision criteria and the proposed mandatory mitigation before proceeding to suggest two preferred alternatives.

After the close of the SDEIS/EIR public comment period, in light of the high degree of public acceptance, EPA decided to retain criteria as a way to impose order on a mass of detail in this especially complex review, and to focus on those impacts which are relevant to the choice of a site. EPA also reviewed all the public comments submitted to identify both those criteria-relevant issues which needed futher analysis prior to selection of a preferred alternative and those other issues which related to the overall project or were otherwise not criteria-relevant, but which were appropriate for inclusion in the FEIS or the FEIR. EPA performed additional analyses on potentially site-relevent topics.

EPA and the MWRA agreed that it was appropriate for each to pursue an independent decision-making process under their respective statuatory mandates but to do so in parallel and with a high degree of coordination. Accordingly, to ensure that both agencies shared a common data base, as either agency identified data needs or developed information, it was shared with the other by exchange of technical memoranda and through technical presentations at meetings with EPA's Technical Advisory Group or with the MWRA's Board of Directors or staff.

EPA systematically reviewed its entire data base using the decision criteria and evaluated each piece of data in terms of one or more of the appropriate decision criteria. EPA felt that each decision criterion was legitimate and was confident that sufficient objective data existed to permit a reasoned judgement as to the acceptability of the alternative sites.

Mandatory Mitigation Measures

Upon the completion of the review of each decision criterion, the assumed level of mandatory mitigation as set forth in the SDEIS/EIR was either confirmed or, if appropriate, modified as the result of further technical information. EPA found that the most critical need for mitigation was to reduce impact on neighbors. EPA applied a set of specific mandatory mitigation measures to all alternative sites except as noted below. The mandatory mitigation measures can be summarized as follows:

. Barging of bulk materials to and from the site to reduce the amount of trucking through affected communities during construction;

. Use of a roll-on/roll-off barge loading facility at the site and at an onshore transfer station to accommodate heavy trucking;

. Busing and ferrying of construction workers to reduce commuter traffic in affected communities during the construction period;

. Use of "maximum feasible degree" of odor control and investigation of state-of-the-art odor control technology;

. A ban on the use of liquid chlorine at Deer Island unless there is "clear and convincing" need for it and proof that it can be handled without unnecessary risk to neighbors, including the prison workers and inmates;

. Implementation of noise control measures during construction, including the excavation of the Deer Island drumlin from the south side so that the remaining mass of the drumlin acts as a shield, and construction of a sound barrier at the Deer Island prison.

. Prohibition against trucking liquid chlorine to Deer Island as soon as piers and staging areas are available to commence over-water transport;

. Exploration of alternatives to the use of liquid chlorine at the treatment plant and at the associated headworks;

. Sampling of volatile organic compounds downwind from the existing primary plants at Deer and Nut Islands, exploration of technologies to control these compounds and installation of appropriate controls if necessry;

. Exploration of alternative treatment processes that might be less space demanding, less costly, or more reliable than secondary treatment based on the activated sludge process;

. Exploration of the feasibility of developing recreational uses of the site along with the treatment plant;

. Control of dust, erosion and sedimentation.

For a detailed statement of the mandatory mitigation measures, see pages 52-55 of the FEIS Volume I. Each of these mitigating efforts will be the subject of detailed study by the MWRA as further facilities planning explores these ways of achieving acceptable levels of impact. EPA, after appropriate environmental review, is prepared to modify these mitigation measures if equally effective protection can be achieved by other methods.

In the judgement of EPA. these stringent mandatory mitigation measures include all practicable means which are necessary and appropriate to avoid or minimize environmental harm from the alternative selected. EPA acknowledges that in some cases its mitigation package differs from the mitigation commitments described in the MWRA's FEIR and its findings under Section 61 of MEPA. EPA is confident, however. that its mandatory mitigation measures would result in an extraordinary degree of mitigation which would effectively minimize environmental harm.

Final Analysis*

During the final analysis. it became clear that three of the decision criteria. through theoretically important, no longer played site-distinguishing roles.

1. On "Cost". a more detailed analysis revealed that the costs of the four alternatives were so close that EPA decided to regard this decision criterion as having neutral effect.

2. On "Reliability". each of the sites permitted treatment plants of equal reliability.

3. On "Impact on Cultural and Natural Resources". though this decision criterion included federally protected resources (wetlands. barrier beaches, recognized historical and archeological sites, etc.), the impact of plants on either Deer or Long Island would be essentially equal and acceptable. On Nut Island, however, the Split Secondary Deer-Nut Alternative would involve the serious impacts of filling of tidal areas (unless homes were taken) and this was taken into account in the final decision.

Thus, "Effects on Neighbors". "Harbor Vision" and "Implementability" remained as the principal decision criteria for EPA. EPA felt each of these three criteria represented protection of important public values of substantial weight and each will be discussed below:

1. With respect to the "Effects on Neighbors" decision criterion, should the "no prison" variation of the All Secondary Deer Island alternative be implemented, EPA concluded that a treatment plant at either Deer Island or Long Island would have acceptable and essentially equal impacts on its neighbors. with the mandatory mitigation measures in place. However. if the prison were to remain on Deer Island, EPA concluded

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* In the following discussion it is important to note that, in the SDEIS/EIR, EPA and the Commonwealth concluded that under both Long Island alternatives, the Long Island hospital must be relocated off-island in order to avoid unacceptable impacts to "Effects on Neighbors", "Harbor Vision" and "Cultural and Natural Resources". EPA believes this conclusion remains valid.

that a plant site on Deer Island would have a greater effect on its neighbors than a site on Long Island, but these impacts as mitigated were acceptable. EPA felt that removal of the prison was desirable but not mandatory. EPA also concluded that the mandatory mitigation reduced the impacts so substantially that the plant could be constructed without unacceptable impact despite the presence of the airport and the prison.

The Split Secondary Deer-Long alternative would involve major construction activity of approximately the same perceived effect on the neighbors of each island as if the entire plant were being constructed there. Though those effects were found to be acceptable, it was felt to be unwise to impact two sets of neighbors unless there would be some benefit to another decision criterion; there was not.

Split Secondary Deer-Nut imposed severe burdens on its immediate neighbors on Hough's Neck without any corresponding benefit to Deer Island and Point Shirely. It was found to be environmentally unacceptable.

2. Considering only the "Harbor Vision" decision criterion, EPA concluded that though all four altenratives were acceptable, the All Secondary Deer alternative was preferred under "Harbor Vision". EPA believes that Deer Island's size, topography and setting give it acceptable long-term potential for rehabilitation as a park resource. However, because of Long Island's current potential as a major island park, EPA did conclude that while both All Secondary Deer and All Secondary Long satisfied the Harbor Vision decision criteria, All Secondary Deer satisfied it better.

Less acceptable were the other two alternatives. Though Split Secondary Deer-Long preserved significant potential recreation space at each island, EPA agreed with the Commonwealth that an entire island as park was preferable. Split Secondary Deer-Nut committed Nut Island to wastewater treatment without any corresponding benefit at Deer Island; though Nut Island has not been a major part of a harbor park plan, it could provide locally important open space.

3. Considering only the "Implementability" decision criterion, the following issues were of principal importance: permits and licenses, and the attitudes of the City of Boston and agencies and legislature of the Commonwealth. Even prior to the July 10, 1985, vote of the MWRA selecting All Secondary Deer Island as its tentative preferred alternative, EPA had concluded that the "Implementability" decision criterion pointed to All Secondary Deer with or without the prison because the principal remaining alternative, All Secondary Long (without the hospital), faced significant opposition. However, EPA was concerned that Deer Island prison removal was uncertain.

The July 10, 1985, and February, 1986 votes, and the MEPA Sec. 61 Findings of the MWRA, the proposing agency, which has the statutory authority to build the treatment plant and which controls much of Deer Island, confirmed EPA's conclusion that the All Secondary Deer alternative was clearly more implementable than any of the other alternatives.

The Governor's continued support of the MWRA, his renewed commitment to facilitate

relocation of the prison. and his new offer to identify a new prison site by May. 1986, further supports this result. Other officials have reiterated their support for prison removal if Deer Island is to be the site. As stated by the Secretary of Environmental Affairs in his Certificate on the FEIR. Janury 21. 1986:

> "...[T]hrough the joint struggle of all branches of government. the courts. the press. and the public. important milestones have now been passed - the creation of the Authority and public consensus on siting. A momentum has now built up, which I consider so powerful that the cleanup cannot and will not be stopped. The joint will of Mayor Flynn, Governor Dukakis. the General Court and our citizens is so strong that I am convinced the difficulties of prison relocation can be overcome...". (emphasis added)

EPA agrees with the MWRA that the reinforced support of relevant public officials for Deer Island prison removal and the continued opposition to Long Island Hospital removal makes prison removal "far more feasible" than hospital removal.

Furthermore. even if the prison were to remain. EPA notes the continued strong opposition of the city and state officials who control the future of Long Island to any use of Long Island as a treatment plant and notes their reiterated support for a Long Island park and for a continued role for the Long Island Hospital and Homeless Shelter.

Therefore, EPA confirms its previous judgement that All Secondary Deer Island (even if the prison were to remain) is more implementable than either of the other two environmentally acceptable alternatives: All Secondary Long and Split Secondary Deer-Long (both without the hospital).

In summary, with mandatory mitigation,

1. EPA found Split Deer-Nut to be environmentally unacceptable because of its severe impact on its "Neighbors" at Nut Island and on "Natural Resources", and strong barriers to "Implementability".

2. EPA found Split Deer-Long (without the hospital) to be environmentally acceptable; but EPA also found it to be undesirable because it spreads impacts on "Neighbors" and "Harbor Vision" to two islands without any benefit deemed valuable to a decision criterion. It also was unlikely to be "Implemented".

3. EPA found both All Secondary Long (without the hospital) and All Secondary Deer to have an acceptable impact on "Neighbors" and "Harbor Vision".
    a. "Neighbors". With mitigation, the impact of a Deer Island plant on its "Neighbors" is either equal to (without the prison) or worse than (with the prison) a Long Island plant.

b. "Harbor Vision". The impact of a Deer Island plant on the public benefits from and uses of Boston Harbor causes somewhat less harm than a Long Island plant.

c. "Implementability". Between these two acceptable and closely balanced alternatives, building a treatment plant on Deer Island (with or without the prison) is clearly more "Implementable" than building a Long Island Plant.

EPA's decision based on the foregoing analysis is that its preferred alternative is All Secondary Deer with mandatory mitigation. The FEIS contains more information on the decision process.

IV. IMPLEMENTATION, MONITORING, ENFORCEMENT OF MITIGATION MEASURES

Applicable regulations require EPA, in this ROD, to adopt and summarize an implementation, monitoring and enforcement program for its mitigation measures.

EPA's first implementation, monitoring and enforcement mechanism will be through the construction grants program. Section 201(g) of the Clean Water Act authorizes the Administrator to grant financial assistance to municipalities for the construction of municipal wastewater treatment plants. Section 511(c) of the Act states that the award of a construction grant may be considered a major federal action significantly affecting the quality of the human environment, subject to the requirements of NEPA. These statutes give EPA the authority to enforce the mandatory measures through the federal construction grants program. The mandatory mitigation measures for the selected site at Deer Island will be made necessary conditions of any Federal construction grants awarded to the MWRA during the Step 3 Construction Phase of this project.

EPA has determined, pursuant to Section IV B 7 of the 1984 Construction Grants Delegation Agreement and 40 CFR Section 3015(c), that an overriding federal interest exists in this project, in particular in regard to the implementation of the mandatory mitigation program specified in the FEIS. In order to ensure that all mandatory mitigation measures are implemented through the construction grants program, the agency will play a direct role in oversight of facilities planning, design and construction of the wastewater treatment plant including piers, outfalls and pipelines/tunnels. The specific role that EPA plans to play will be at least as follows:

. review all sections of all the facilities plans to ensure compliance with the mandatory mitigation program as set forth in FEIS Volume I, p.53-55.

. coordinate with the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Water Pollution Control in reviewing the plan of study for the facilities plans.

. participate in any technical and citizen advisory committees as part of the public participation program for the facilities plans.

. participate in the review of the draft products of the facilities plans, particularly the development of the mandatory mitigation measures.

. EPA will review at least the specfics of the proposed odor control program, noise control program and possible volatile organic compound emissions control program to ensure that MWRA is achieving effective impact reductions required by this ROD. On the issue of liquid chlorine use. EPA will ensure in its review of the facilities plan that MWRA has undertaken a thorough disinfectant alternatives analysis. On the issue of busing, ferrying and barging, EPA will monitor the development of the facilities planning investigations to ensure that MWRA establishes the required programs to mitigate transportation impacts.

. coordinate with DEQE for joint review and approval of the final facilities plans. The facilities plans will be approved only upon successful development of the mitigation program as outlined in the FEIS.

. EPA will request the Army Corps of Engineers, during construction, to make periodic onsite reviews to ensure that the project is being managed properly, is on schedule, and is being constructed in accordance with approved construction drawings and specifications including mitigation measures and change orders.

In order to facilitate a high degree of review oversight by EPA, the agency intends to enter into an agreement with the DEQE Division of Water Pollution Control and MWRA to outline further details of EPA's oversight.

In addition to EPA oversight and participation in further facilities planning, EPA intends to assume primary responsibility for NEPA review by the preparation of any environmental assessments or supplemental EIS's determined to be necessary in connection with these activities. EPA and the Army Corps of Engineers plan to enter into a Memorandum of Understanding in order to minimize delays in any environmental reviews involving both agencies.

Second, the MWRA is under federal court order to initiate facilities plans for the shore-side piers and staging areas, on-site piers and staging areas, outfalls and tunnels or piplines. The MEPA unit of the Executive Office of Environmental Affairs has made the determination that EIR's will be prepared on these facilities plans. In addition, the facilities plans will include EID's which provide environmental evaluations of the final facilities plan components. EPA will conduct an independent environmental review, under NEPA, of these facilities plans, except for those aspects of the wastewater treatment plant covered by this EIS.

Third, in the unlikely event that federal funding for this project were to be totally unavailable due to the termination of the Construction Grants Program, this project will require other federal actions which bring it within NEPA. These include the transfer of surplus federal lands by the General Services Administration (GSA): permit actions by the Corps of Engineers for the construction of piers and the disposal of dredged material or fill: and possible permit actions by EPA for the ocean disposal of fill. Each of these actions triggers independent opportunities to implement and enforce the mitigation program. For example, GSA intends to dispose of the surplus property in accordance with the FEIS and has committed to incorporate the mandatory mitigation measures into its own Record of Decision as appropriate.

Fourth, this project is now the subject of a federal court action (United States of America v. Metropolitan District Commission, et al., Civil Action No. 85-0489 D.C. MA and a related case.) In the event of the cessation of the construction grants program, EPA will also consider seeking an order of the federal court mandating that the mitigation program laid out in the FEIS be implemented.

Fifth, it should also be noted that the MWRA has committed to the Commonwealth that it will undertake a set of mitigation measures which are, with the exception of prison removal, substantively equivalent to those required by EPA. These are contained in the Section 61 Findings of the MWRA to the Secretary of Environmental Affairs under the MEPA.

[See Section 3.2 Siting Decision, Subsection Final Selection in this Volume.]

FURTHER ENVIRONMENTAL REVIEW UNDER NEPA

EPA expects that further environmental review under NEPA relating to the cleanup of Boston Harbor will include appropriate study of the following phases of the process, including cumulative impacts:

1. Long-term residuals management, including the processing, transport and ultimate disposal of sludge. Scoping for this EIS has already commenced.

2. The construction of pier(s) and staging area(s) at the treatment plant site and on shore to allow for barging of bulk contruction materials, equipment, and work crews during construction, and possible transport of sludge. In the event that an existing pier cannot be located on the mainland, an additional pier or piers and staging area(s) would need to be constructed there.

3. The construction of an under-harbor tunnel or pipeline to transport wastewater to the treatment plant.

4. The water quality and construction impacts of an outfall pipe or pipes through which effluent will be discharged.

5. The possible disposal of earthen or dredge materials which might need to be removed from the site of the secondary treatment plant prior to construction.

6. The possible transport, handling, storage, and use of chlorine at the secondary treatment plant, depending upon the outcome of studies by MWRA regarding the environmental acceptability of its transport, handling, storage and use.

7. Combined sewer overflow projects.

CONCLUSION

EPA has engaged in a decision process which gathers technical information, exposed it to extensive public scrutiny, developed very stringent mitigation measures, and evaluated the alternatives in terms of disclosed decision criteria. EPA believes this open process has arrived at a fair and reasonable conclusion that the upgraded treatment plant, considered singly or in combination with other conditions, will be constructed and operated with acceptable environmental results.

3.3 RELATED PROJECTS

Projects

Although the Secondary Treatment Facilities Plan is the beginning of the key project in the Boston Harbor Cleanup Program, there is a long list of projects that are being planned, designed or are under construction to upgrade and expand the MWRA's wastewater collection and treatment capabilities. These projects are grouped into the following programs:

Treatment Plant Upgrade
  Nut Island Immediate Upgrade
  Deer Island Fast Track Improvementss
Interim Residuals Management
  Interim Sludge Processing and Disposal
  Interim Scum Management
Long-Term Residuals Management
Water Transportation Facilities
Combined Sewer Overflows
Harbor Research and Monitoring

In addition to the above wastewater programs, several waterworks projects have either a direct or an indirect bearing on the secondary treatment facilities planning. MWRA has also initiated several projects to strengthen its ability to direct and manage its extensive capital program and its extensive day-to-day operational responsibilities. The projects designed to strengthen MWRA's institutional capability are described in Volume VII, Institutional Considerations. The

related wastewater programs are described briefly in the following paragraphs.

Industrial Waste Program

In February of 1973, MWRA's Industrial Waste Program began to acquire data on all industries within the 43 cities and towns which comprise the sewerage district. This program has become the means whereby the Authority enforces Federal, State and MWRA regulations which govern the discharge of wastewater to the sewer system. The goals of the enforcement strategy are to decrease and control pollution loads to the treatment works; increase safety for maintenance and operational personnel; reduce illegal waste discharges such as extraneous water and septage from non-member municipalities; and prosecute for willful damage or vandalism.

The Industrial Waste Program, which was approved by the EPA in July of 1982, is being implemented in four phases: Inspections, Monitoring, Permitting and Enforcement.

Inspection Activities

The inspection program includes on-site inspection of all indusries in the district. It requires a discussion period with appropriate plant personnel to ascertain the type of activity being performed at the facility, the raw materials used, products and services produced, and the particular processes and unit operations employed. A tour of the facility is also conducted to verify the information received. Industries suspected of discharging a questionable waste are required to submit the results of laboratory analyses, performed on representative samples of the process waste by an independent laboratory, for review and evaluation by the Authority. The results of analyses, along with other pertinent information (permit application, inspection reports) on the industry, are used to determine whether or not the wastes are in compliance with the MWRA's Rules and Regulations. A permit application must be completed by all users discharging industrial wastes.

An intensified Industrial Inspection Program has commenced as a result of the increase in staff and resources. In Fiscal Year 1987, approximately 425 industrial inspections were conducted.

Septage Disposal Inspection Program

The Septage Disposal Inspection Program is basically divided into two activities: first is the oversight of the septage control activities of the member municipalities with septage receiving locations; and second is surveillance of each septage receiving location to determine compliance with MWRA Rules and Regulations and to identify any illegal septage dumping.

Each member municipality which operates or has designated a septage receiving station is responsible for the control and monitoring of all activities at the septage receiving location. The Water Quality Section evaluates control procedures at each septage receiving location for the purpose of determining the municipality's ability to control the dumping of septage from non-member communities, to prevent the discharge of industrial or toxic wastes, and to verify the origin of all septage receiving at each septage receiving location.

In some instances the possibility of illegal or uncontrolled dumping at certain septage receiving locations is suspected. In response to these instances, surveillance of the septage receiving site is conducted in order to document septage disposal, and possibly identify illegal dumping activities requiring enforcement of dumping restrictions.

Identification of I/I and Surcharging During Routine Investigations

In adddition to identifying sources of toxic discharges to the sanitary sewer system, investigations at industrial facilities often identify the illegal discharge of "clean" water, also known as inflow. During these industrial investigations the most common form of inflow uncovered is non-contact, uncontaminated cooling water and non-contact, uncontaminated industrial process water.

In addition to identifying these and other sources of inflow, inspection personnel often identify excessive use of water and make recommendations to limit water use. These recommendations serve to reduce the flow in the already overloaded sewer system, which helps to minimize surcharging.

Monitoring Activities

The Monitoring Section of the Water Quality Department continually participates in a variety of activities, the most significant being monitoring for the Industrial Waste Pretreatment Program. More specialized areas of monitoring include sampling at the Treatment Plants, fulfilling NPDES Permit monitoring requirements, soil sampling, beach sampling, and verification of discharges and connections. Monitoring activities during Fiscal Year 1987 numbered 565, compared to 200 in Fiscal Year 1986.

Collection of industrial waste samples from industries discharging into the Authority Sewer System yields a profile of industrial wastes currently entering the system and provides the basis for enforcement to eliminate unacceptable concentrations of toxic and potentially harmful substances. The samples collected are forwarded to a laboratory for analysis, where strict Quality Assurance/Quality Control procedures are employed. Analytical results from this monitoring, in conjunction with information derived from inspecting and permitting activities, assist in determining the acceptability of the discharge and whether enforcement action is warranted.

The Monitoring Team has been involved in site assessment and the implementation of the monitoring program to fulfill the NPDES Permit requirements. The permit requires monitoring at Deer and Nut Island Treatment Plants and at three Combined Sewer Overflow (CSO) facilities (Cottage Farm Chlorination and Detention Station, Charles River Estuary CSO Treatment Facility, Somerville Marginal CSO Pretreatment Facility). At the treatment plants, samples are taken monthly for parameters not monitored daily by the plants, such as organics, metals and cyanide.

Beach sampling has been frequently requested in response to reports of odor problems and unidentified growths or discharges into the harbor.

Other monitoring activities include sampling soil or sludge to determine the degree of contamination to assist in proper disposal decisions, verification of discharges and connections via dye tests and researching sewer line maps, groundwater sampling, and sampling at construction or cleanup sites before discharge to the sanitary sewer system.

Municipal Permits/Sewer Use Discharge Permits

Sewer Use Discharge Permits are issued to each sewer user discharging industrial wastes located in the Authority Sewer District regardless of size, type or volume of discharge. For permitting purposes, the Sewerage Division has classified users into four categories according to the nature of their wastes. The categories are as follows:

1. Industries requiring pretreatment.
2. Industries having some toxic discharges but at concentrations which do not require pretreatment.
3. Industres which have non-toxic discharge in addition to sanitary flow.
4. Dry industries or industries with sanitary flow only.

Sewer Use Discharge Permits are revised as new information is received. At present, much of the activity involving permits is due to revisions and renewals, which are done on a daily basis.

Compliance and Enforcement

The Authority has been extremely successful in working with its Sewer Users in a cooperative spirit to eliminate existing or potential discharge problems, since the inception of the Industrial Waste Program. Over the years, thousands of industries and other sewer users have been inspected, monitored and issued permits. Through the inspection, monitoring and permit phases of the Water Quality Department's Industrial Waste Program, many of these industries were found to be in violation of acceptable discharge practices. Any continued violations of permit conditions or Sewer Use Rules and Regulations will result in enforcement actions to assure compliance with acceptable discharge practices. New Sewer Use Rules and Regulations promulgated May 1, 1987 have broadened the scope of MWRA enforcement powers, including rights to:

1. Issue an order to cease and desist any such discharge violations:

2. Direct a User to submit a detailed schedule, subject to such modifications as the Authority deems necessary, setting forth actions to be taken to correct or prevent a violation:

3. Issue an implementation schedule ordering specific actions and a time schedule;

4. Revoke, modify or deny a permit issued to the User by the Authority:

5. Impose administrative penalties up to $10.000 per day of continued violation. and seek payment for damages to its system pursuant to 360 CMR 10.105 and 360 CMR 2.00;

6. Bring a civil or criminal action as provided by law;/ or

7. Take any other action available to it under federal. state or local law or regulation.

In cases where significant resistance is given to the Authority's discharge regulations, enforcement actions have been initiated. Enforcement actions to date range from informal meetings with the offending companies to legal actions taken through the Office of the Attorney General of the Commonwealth of Massachusetts. The results have been civil penalties ranging upward of $600,000 and agreements for judgements mandating adherence to strict compliance schedules.

The Authority's newly promulgated Administrative Penalty Regulations and Rules for Adjudicatory Proceedings will enable the Water Quality Department to be more effective in enforcement. The Authority is also establishing firmer policy and procedures which will be followed for the imposition of Civil Penalties in those future cases which require the assessment of fines.

Treatment Plant Upgrade Programs

Both the existing Deer Island and Nut Island Treatment Plants are being upgraded to extend the useful life of the installed facilities until the new treatment facilities can be constructed and placed into operation.

The Nut Island Immediate Upgrade Project began in January, 1983 and is expected to be completed in May. 1988. Eight projects costing approximately $12 million have been initiated to extend the useful life of the Nut Island Plant approximately ten years. Table 3.3-1 summarizes the eight immediate upgrade projects. Table 3.3-1 also describes other projects that are planned or underway to rehabilitate the existing treatment plant.

The Deer Island Treatment Plant Fast Track Improvementss Program consists of several projects to raise the operating efficiency of the existing plant to an acceptable level. The construction of these upgrading projects started in June. 1986 and is expected to be completed in March. 1990. The Deer Island Fast Track Improvements Program is summarized in Table 3.3-2. Other projects that are expected to improve the service life of the existing facilities on Deer Island are also described in Table 3.3-2. These rehabilitation projects also include upgrading the remote headworks facilities which function as an integral part of the Deer Island Treatment Facilities.

TABLE 3.3-1
NUT ISLAND IMMEDIATE UPGRADE

- Power
  - Rebuilding of one engine generator
  - Installation of 2000 kw transformer for purchased off-site power to the site

- Preliminary Treatment
  - Addition of influent flow meter (sonic type) on the High Level Sewer
  - Installation of new ventilation system, odor control equipment, and explosion-proof electrical components to the grit facility
  - Removal of comminutors downstream from the grit chambers
  - Rebuilding of the effluent channels from the grit tanks
  - Replacement of air header to the preaeration basins
  - Rebuilding of one preaeration blower motor

- Primary Sedimentation
  - Structural rebuilding of tanks and repairing of leaks
  - Levelling of tank floors
  - Replacement of all weirs
  - Replacement of sludge collection equipment

- Digesters
  - Replacement of outside sludge piping from the primary sludge pumps to the anaerobic digesters
  - Digester roof rehabilitation

- Outfalls
  - Installation of an automated sluice gate at the outfall
  - Cleaning of the two main outfalls

- Electrical Distribution Substation Replacement

- Sewerage Pump Switchgear Replacement

TABLE 3.3-2

DEER ISLAND TREATMENT
FACILITY
FAST TRACK IMPROVEMENTS

- Pump Station and Power Station Improvements

  - 5 new 90 mgd influent sewage pumps
  - 4 new 2000 Hp electric motors
  - New graphic control center to monitor sewage flow
  - New cooling water system for engines
  - New pumps for process water building
  - New heating system process water building
  - 2 new 6000 kw dual fuel, engine/generator sets
  - New switch gear/electrical distribution center
  - New fuel storage system for engines

- Rehabilitation of Digesters
  - 4 new floating roofs
  - New internal digester piping
  - New gas meters at each digester
  - New waste gas burners with meters
  - 6 new spiral heat exchangers
  - 4 new sludge hot water pumps
  - 1 new boiler
  - Rehabilitation of 2 Ingersoll-Rand gas compressors
  - A new heating and ventilating system for both the sludge thickener and the digester complexes
  - A gas detection system for both complexes

- Sludge Thickener Improvements

  - Remove existing tank mechanisms
  - Remove existing bridges, pumps and associated piping
  - Install new thickener mechanisms and bridges
  - Install new sludge transfer system, pumps and compressors
  - Install associated piping, electrical and control instrumentation

- Primary Sedimentation Basins Improvements

  - New grit collection system
  - New grit classification building
  - New scum concentration building

Table 3.3-2 (cont'd)

- New chemical feed building
- Influent and effluent sampling stations
- 80 new motorized influent sluice gates and 80 stainless steel baffles
- New flow splitter plate, to equalize grit distribution
- Structural repairs to the sedimentation basins and bridges
- 48 new stainless steel aeration leaders and diffusers
- 3 new air compressors for the aeration channels

o Chlorine Rehabilitation

- 8 new evaporators
- 8 new chlorinators
- 2 new scale systems
- New HVAC system
- New roof
- New piping and distribution system for chlorine and process water

o Electrical Upgrade

- 4 new electrical distribution substations
- New conduit for substations
- New motor control centers throughout Deer Island

o Dual Fuel/Generator Overhaul

- Overhaul of 5 diesel enginers 1000 Hp
- Overhaul of 4-700 kw generators

o Deer Island Remote Headworks Improvements (Columbus Park, Chelsea Creek and Ward Street)

- New grit collection and removal equipment for all 12 channels (four at each facility)
- New climber-type mechanical screens
- New HVAC equipment
- New odor control equipment
- Improvements to electrical systems
- Monorails, hoists and bridge cranes
- Hydraulic power units for sluice gates

o Winthrop Terminal Headworks Improvements

- Three climber-type mechanically cleaned bar screens
- Grit collection equipment

Table 3.3-2 (cont'd)

- Three inlet sluice gate operators and hydraulic power system
- Overhaul six sewage pumps (4-16,00 gpm and 2-32,000 gpm)
- Six new drive motors and controls
- Screening discharge enclosure
- Two stair access/egress towers

Interim Residuals Management Program

The Interim Residuals Management Program is intended to provide the facilities necessary to cease the discharge of sludge to the ocean by 1991. MWRA is presently soliciting proposals from private firms to provide land based disposal of sludge until the long term management facilities now being planned are constructed in 1995. The Interim Residuals Management Program includes sludge from both the Deer Island and the Nut Island Treatment Plants.

A second component of the Interim Residuals Management Plan is interim scum management. Scum is the floatable material that is skimmed from the surface of sedimentation facilities at both treatment plants. Scum is currently mixed with the sludge and discharged to the harbor. Because these materials are the more obnoxious and visible discharged to the harbor, the removal of these materials has been given the highest of priorities. For the interim period at Nut Island, scum screening, chemical conditioning and landfill disposal was selected as the recommended scum handling option. Design of these facilities was initiated in May, 1987. At Deer Island, the recommended plan for termination of scum discharges involves a one year demonstration project. This project includes chemical fixation of all Deer Island scum by a private contractor with storage on-island. Initiation of this period is anticipated in November, 1987. At the end of the one year demonstration, a decision will be made to build permanent facilities or to continue with a service contract.

A third component of the interim residuals management plan is a composting pilot plant. Composting stabilizes organic materials and destroys bacteria and viruses in sludge. Composted sludge has the potential for use as a soil supplement for production of turf grass, horticultural uses at green houses, use as a low-grade fertilizer or use as a landfill cover material. The pilot plant was initiated in 1984 and currently processes fifteen dry tons per day of sludge. The pilot plant serves the dual purpose of reducing the quantity of sludge discharged to the harbor and at the same time provides a compost product to test and develop a market for the material in the greater Boston area. The compost pilot also provides valuable information for the assessment of the viability of composting as a long-term residuals management option.

Long-Term Residuals Management Facilities Plan

The facilities planning for the long term management of residual solids is being conducted concurrently with this planning effort. The planning effort includes assessment of the quantity and quality of Deer Island and Nut Island sludge, survey of available sludge processing and transport technologies, selection of appropriate technologies, screening of potential disposal sites and selection of optimum facilities and sites. Design and construction will include both on-island and mainland facilities. The facilities planning is scheduled for completion in 1988. Figure 3.3-1 illustrates the general flow of planning activities for the residuals management facilities plan.

Water Transportation Facilities

The Water Transportation Program includes the construction of the piers and related facilities to move materials, workers and equipment to and from Deer Island for the construction of the new treatment facilities and at Nut Island to support construction of the new headworks facility. Facilities planning for both on-island and on-shore piers is essentially complete. On-island piers are now being designed. Construction of these essential facilities is expected to commence in March, 1988 and be completed in September, 1989. Construction of the on-shore piers is expected to start in September, 1988 and be completed in May, 1990. See Figure 3.3-2 for a schedule of water transportation facilities planning.

Combined Sewer Overflow Program

MWRA is currently evaluating a means of abating pollution from combined sewer overflows. Figure 3.3-3 denotes the overall facilities planning for the CSO program.

Harbor Research and Monitoring

The ultimate goal of this project is the design and implementation of a plan for action directed towards cleaning up Boston Harbor and protecting the Harbor in the future.

A Technical Advisory Group (TAG), established in 1986, produced a "Study Plan for Basinwide Management of the Boston Harbor/Massachusetts Bay Ecosystem". This plan defined the goals for research and monitoring in Boston Harbor and Massachusetts Bay that will be closely tied to management issues. The study plan further identified many issues facing environmental managers. Of these issues, five have been identified as high priority, requiring a well-focused scientific study.

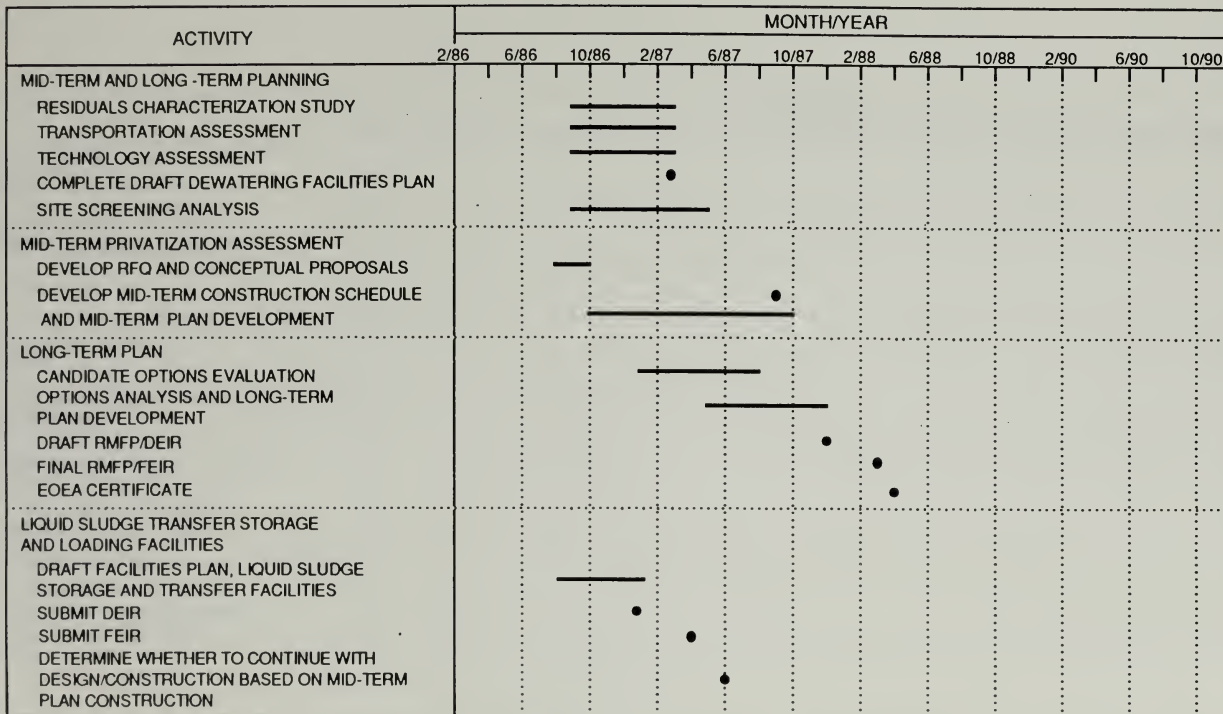

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FIGURE 3.3-1
RESIDUALS MANAGEMENT
PROJECT SCHEDULE

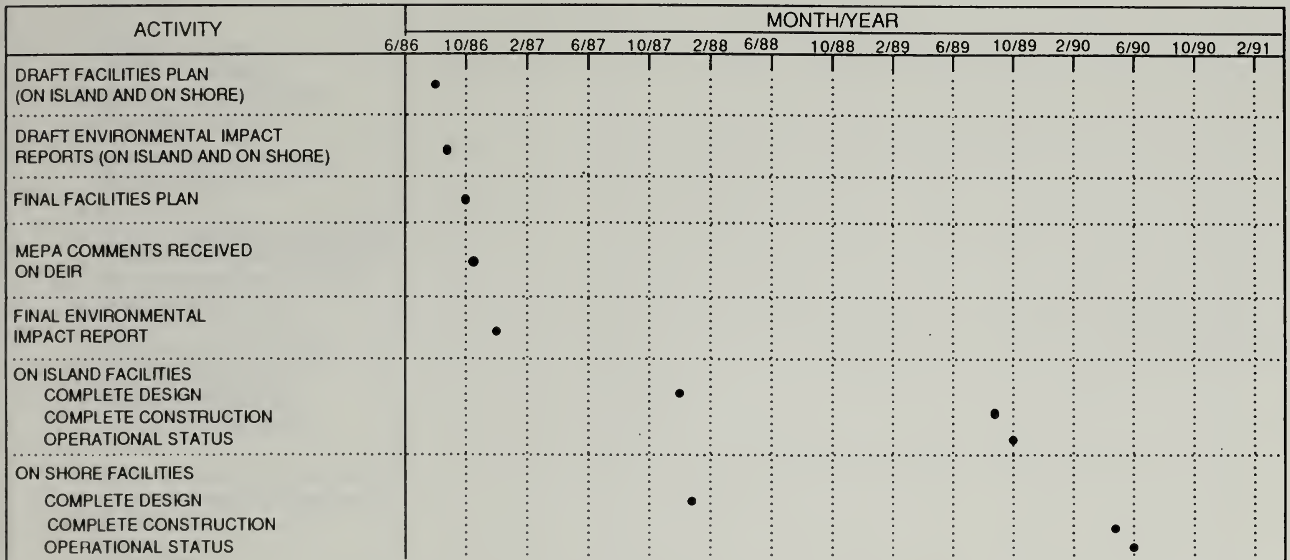

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FIGURE 3.3-2
WATER TRANSPORTATION FACILITIES
PROJECT SCHEDULE

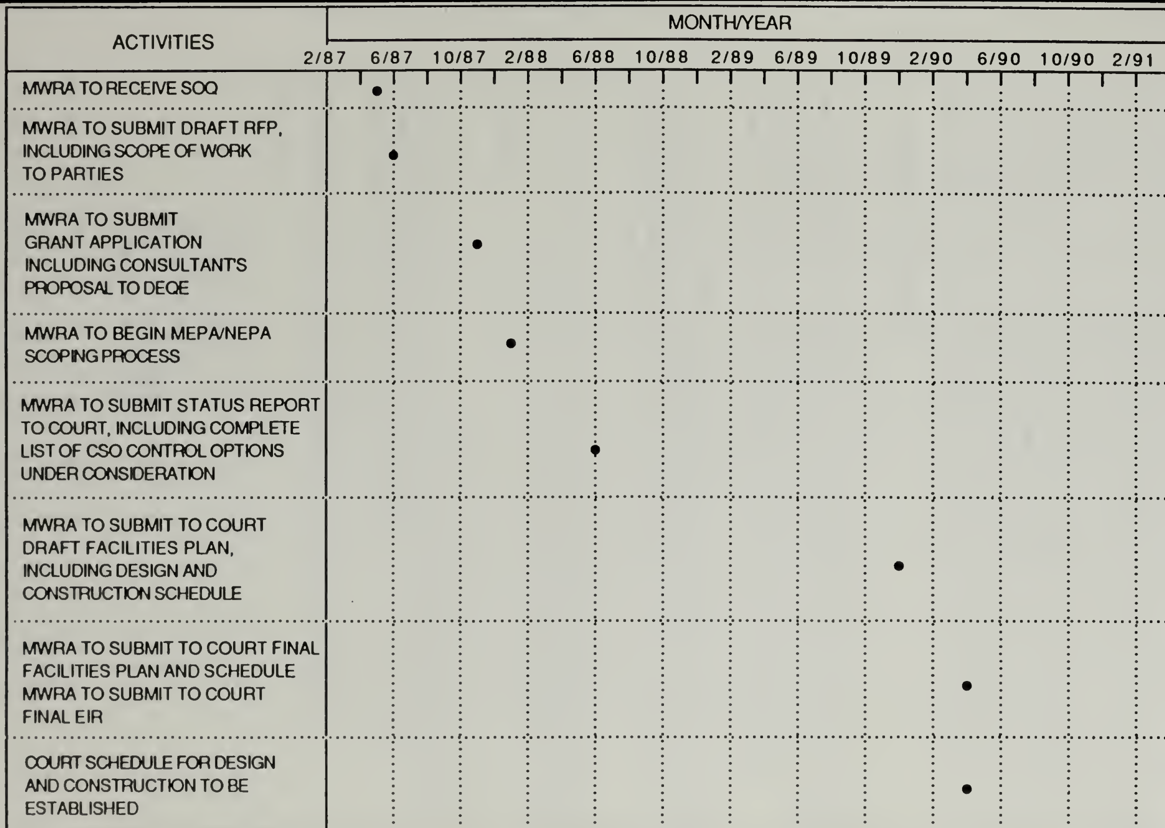

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FIGURE 3.3-3
COMBINED SEWER OVERFLOWS
PROPOSED PROJECT SCHEDULE
BEGINNING MAY 1987

MWRA plans to participate in a joint public and private effort to establish a Harbor monitoring and research program. The program will conduct research that will report on existing conditions and measure incremental change as the residuals management program and treatment plant upgrading are implemented. The priority areas to be studied include: (1) sources and fate of contaminants; (2) effects of contaminants and the health of the living resources; (3) nutrient enrichment; (4) economic, legal, political and social science assessment and; (5) public health impact. The study of these areas requires both short term projects designed to answer particular questions and a monitoring program that will determine long term impacts of human activities on the marine ecosystem. The technical results produced by these studies should be used in multiple-use management endeavors conducted by several agencies.

3.4 PROJECT MILESTONES

Though pollution of Boston Harbor has been a matter of public concern since the late 1960's, awareness was heightened in December of 1982 when the City of Quincy filed a lawsuit against the Metropolitan District Commission and the Boston Water and Sewer Commission (BWSC). Quincy sought relief from the pollution of Quincy Bay, which it claimed was resulting from the discharges of untreated and partially treated sewage from Nut Island and Moon Island.

As a result of this suit and the recommendations of the court-appointed special master, a bill was filed to remove sewer responsibilities from the MDC and to place them in a financially and organizationally independent public authority. On December 19, 1984, the Massachusetts Water Resources Authority was created.

On the following day, the EPA announced its intention to take additional action to help secure a harbor cleanup and brought suit in federal court, requesting a set of deadlines for pollution control projects. Filed at the end of January, 1985, the suit named four defendants: the MDC, the MWRA the state and the BWSC.

As a result of this lawsuit, on May 8, 1986 the United States District Court of Massachusetts imposed "major milestones" as long-term target dates to assist facilities planners toward the completion of primary and secondary treatment facilities. These dates are as follows, with milestone dates relating to this facilities plan in bold type:

Design and Construction of Piers and Staging Areas and Facilities Planning

On-Island

a.	Complete Design	12/87
b.	Bid Construction	5/88
c.	Award Construction	8/88
d.	Complete Construction	9/89
e.	Attain Operational Status	10/89

On-Shore

a.	Complete Design	1/88
b.	Bid Construction	6/88
c.	Award Construction	9/88
d.	Complete Construction	5/90
e.	Attain Operational Status	6/90

Facilities Planning

a.	**Project Start**	**5/86**
b.	**File ENF (s) (see appendix F of this volume)**	**6/86**
c.	**Complete Draft Facilities Plan**	**9/87**
d.	**Complete Draft EIR**	**10/87**
e.	**Complete Final Facilities Plan**	**12/87**
f.	**Complete FEIR**	**2/88**
g.	**Complete Environmental Review**	**4/88**
h.	**Accept Facilities Plan**	**5/88**

Construction of Treatment Plant, Outfall and Inter-Island Wastewater Conveyance System

a.	Initiate construction of new primary treatment facilities	12/90
b.	Complete construction and commence operation of new primary treatment facilities	7/95
c.	Initiate construction of outfall	7/91
d.	Complete construction of outfall	7/94
e.	Initiate construction of inter-island wastewater conveyance	4/91
f.	Complete construction of inter-island wastewater conveyance	12/94
g.	Initiate construction of secondary treatment facilities	during 1995
h.	Complete construction of secondary treatment facilities	during 1999

The 1986 Court order allows for the re-examination of these long-term target dates for the completion of this Facilities Plan.

Section 3 References

G.L.C. 30 Section 61, Findings by the MWRA on the Selection of Deer Island as the Site for Wastewater Treatment Facilities in Boston Harbor.

Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, January 1, 1987. Project Update Boston Harbor Cleanup Effort, prepared by Steven G. Lipman.

Massachusetts Water Resources Authority, November, 1985. Final Environmental Impact Report on Siting of Wastewater Treatment Facilities for Boston Harbor.

City of Quincy v. Metropolitan District Commission No. 138477, Superior Court, August, 1983, Report of the Special Master Regarding Findings of Fact and Proposed Remedies.

Technical Advisory Group For Boston Harbor and Massachusetts Bay, Massachusetts Executive Office of Environmental Affairs, July, 1986. Study Plan For Basinwide Management Of The Boston Harbor/Massachusetts Bay Ecosystem.

Section 4

SECTION 4.0 BASIC PLANNING CRITERIA

4.1 PLANNING PERIOD

The planning period used in this facilities plan encompasses the period from now through the year 2020. This represents the first twenty years of operation of the secondary plant which has been stipulated by the federal court to be in operation not later than the end of 1999. The use of twenty-year planning periods is considered generally accepted practice in the engineering profession, and is required by facilities planning regulations issued by the U.S. Environmental Protection Agency (EPA).

4.2 SERVICE AREA

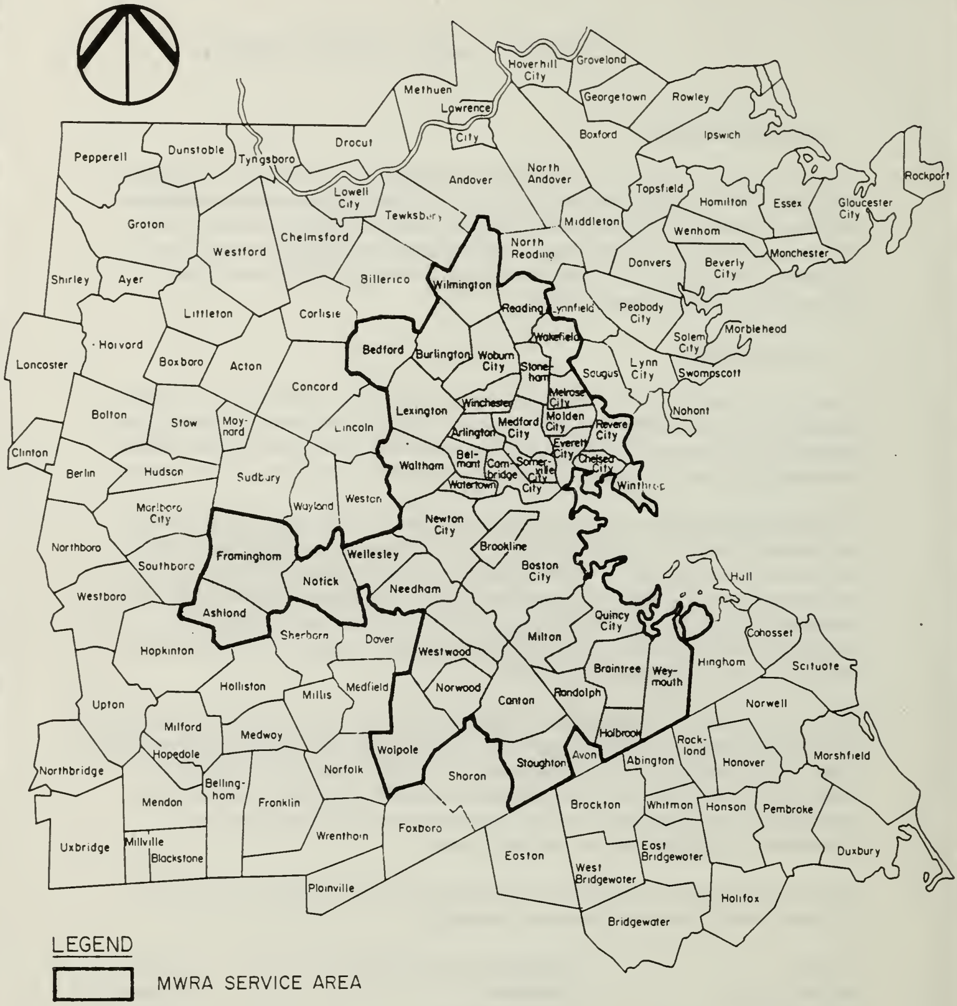
Under its enabling legislation, MWRA is charged with providing treatment to the wastewaters generated in 43 municipalities and special districts. The legislation permits permanent sewer service to other communities, but only after these communities have shown that no feasible alternatives exist, and after numerous regulatory and legislative approvals have been obtained.

Expansion of the service area, if it takes place, will occur at the boundaries of the existing service area. Figure 4.2-1 shows the existing service area, together with communities which are adjacent to the boundary of the area. Most of the communities abutting the Authority's service area are already served by a wastewater system. Any system expansion which might be considered would be on a very limited basis due to existing wastewater utilities on the perimeter of the MWRA service area. Therefore, in developing population and flow projections, the existing service area was used as a base.

Currently, MWRA owns and operates two wastewater treatment plants, one at Deer Island and the other at Nut Island, which handle wastes from the North and South Metropolitan Sewer Service Areas. Some communities in the service area are serviced by both plants. At present, the system provides preliminary and treatment, which consist of screening and grit removal, sedimentation, and chlorination. They then discharged both the treated effluent and concentrated, digested sludges into the Boston harbor.

The Nut Island Facility (servicing the South System) has been in operation since 1952 and presently serves the following twenty-one communities:

Ashland	Hingham (N. Sewer Dist.)	Quincy
Boston (portion)	Holbrook	Randolph
Braintree	Milton (portion)	Stoughton
Brookline (portion)	Natick	Walpole
Canton	Needham	Wellesley
Dedham	Newton (portion)	Westwood
Framingham	Norwood	Weymouth



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 4.2-1
MWRA SERVICE AREA

The Southern System encompasses an area of approximately 240 square miles and presently has a total population of approximately 750,000 and a contributing population of approximately 630,000. Five MWRA pumping stations are located throughout the South System contributing area.

The Deer Island Facility (servicing the North System) has been in operation since June 1968 and serves twenty-six communities. The area served by this treatment plant is approximately 170 square miles with a total population of approximately 1,300,000 and a contributing population of approximately 1,250,000. Six MWRA pumping stations are located throughout the North System contributing area. Member cities and towns include:

Arlington	Lexington	Stoneham
Bedford	Malden	Wakefield
Belmont	Medford	Waltham
Boston (portion)	Melrose	Watertown
Brookline (portion)	Milton (portion)	Wilmington
Burlington	Newton (portion)	Winchester
Cambridge	Reading	Winthrop
Chelsea	Revere	Woburn
Everett	Somerville	

4.2.1 DATUM PLANES

The base elevation to be utilized in the facilities plan is the MDC Sewer Datum. This is compatible with the datum previously used for the existing Deer Island and Nut Island treatment facilities.

Various datum planes are used in the Boston area, most commonly Mean Sea Level Datum (USGS datum of 1929), Boston City Base, and the MDC Sewer Datum. Table 4.2-1 has been prepared to present the relationship of the various datums to the MDC Sewer Datum.

TABLE 4.2-1

DATUM PLANES

To Convert From	To	Add
USGS Datum	MDC Sewer Datum	105.62 ft
Boston City Base	MDC Sewer Datum	99.97 ft

4.3 CRITERIA FOR PRELIMINARY EVALUATION OF UNIT PROCESSES

In order to screen the unit processes considered for wastewater treatment at the proposed Deer Island facilities, screening criteria were developed. Each unit process was evaluated on the basis of area requirements, experience, performance at large municipal wastewater treatment facilities, and relative capital and operating costs. Following these critical criteria, each unit process was then compared to a reference unit process that accomplishes the same function, using 14 additional criteria. The comparison considers the utilization of the unit process at Deer Island and may not necessarily represent the evaluation of other treatment facilities or a generic comparison of unit processes. The unit processes are examined in four function areas: preliminary treatment, primary treatment, secondary treatment, and disinfection. The reference processes for preliminary treatment are aerated grit and catenary screens; for primary treatment, standard rectangular clarifiers; for secondary treatment, air activated sludge and rectangular secondary clarifiers; and for disinfection, the use of liquid chlorine.

4.3.1 SCREENING CRITERIA

The following paragraphs define each criterion and describe how the criterion was used to screen unit processes. Table 4.3.1-1 summarizes the evaluation criteria and ratings.

Area Requirements

Area requirements were estimated for each unit process by use of process sizing criteria. The criteria for each unit process are presented in the following sections. A plant average day flow of 500 mgd was utilized to determine the volume and/or surface area required. Since all unit processes require multiple units, the space between units was taken into account in the area requirements. However, the total area presented does not include area for support support facilities, roadways, or interprocess flow conveyance. Area requirements should be compared to unit processes accomplishing the same function. Unit processes requiring significantly more area than the reference unit process will likely be eliminated from further consideration since land area available at Deer Island is limited.

TABLE 4.3.1-1

SUMMARY OF EVALUATION CRITERIA FOR UNIT PROCESS EVALUATION

Reliability	low	avg.	high
Flexibility	low	avg.	high
Constructibility	difficult	normal	-
Safety	special	normal	-
Operators Required	greater	avg.	fewer
Operational Complexity	difficult	avg.	simple
Power Efficiency	low	avg.	high
Auxiliary Needs	(no auxiliary need or specific need)		
Residuals Aspects	difficult	avg.	good
Spoils Disposal	difficult	avg.	simple
Air Emissions Control	difficult	avg.	none.
Noise Control	difficult	avg.	good
Aesthetics	-	avg.	good
Effluent Quality	low	avg.	high

Municipal Wastewater Experience and Performance

The experience and performance of each unit process were evaluated at large municipal wastewater treatment facilities. Some of the information reviewed included the number of years of operation, size of facilities, history of operation and maintenance, problems encountered, ability to handle peak flows, and performance as measured by process effluent quality. If a unit process had not been demonstrated successfully at a large municipal wastewater treatment facility, it was not selected for detailed evaluation.

Capital Costs and Operation and Maintenance Costs

For both of these cost criteria, the unit processes were compared on the basis of relative costs. The basis of comparison was the reference unit process presented above. Several sources were used to develop relative costs including published cost curves, actual bid costs, and costs supplied by manufacturers. Most unit processes that achieve the same function are similar in cost.

Only unit processes that are significantly lower or higher in costs than the reference unit process will be noted in the discussion. If the capital or operation cost of a particular unit process exceeds the reference unit cost by 50 percent, that unit process will likely be eliminated from further consideration.

Reliability

Reliability is defined as the level of assurance that the unit process will consistently achieve the required degree of treatment under the expected range of operating conditions. This criterion takes into account the track record of the unit process at other large municipal wastewater treatment facilities. For this study, unit processes are rated using one of three levels of reliability: "high", "average", or "low". Unit processes ranked "high" consistently achieve the required degree of treatment. A unit process ranked "average" can be expected to have occasional process upsets but normally meets standards and is comparable to the reference unit process. A unit process ranked "low" has a record of poor reliability or represents a new unproven process.

Flexibility

Flexibility is defined as the degree to which a unit process will operate under upset conditions or major changes in flows or loadings. An upset condition may be defined as out of normal range but anticipated. For this study, unit processes are rated using one of three levels of flexibility: "high", "average", or "low". A unit process ranked "high" is not significantly affected by upset conditions or changes in flow or loadings. Unit processes ranked "average" are sometimes affected by these conditions, and unit processes ranked "low" cannot be expected to achieve design requirements during upset conditions such as changes in flow or loadings.

Constructibility

Constructibility takes into account many aspects of the construction of a unit process. These include the degree of construction difficulty, duration, and scheduling. The constructibility of a unit process will also be influenced by the degree to which supporting barge and staging areas are required. For this study unit processes are rated as presenting "difficult" conditions for construction or presenting "normal" conditions.

Safety

Safety is a criterion used to judge the level of precautions needed to reduce risks to plant personnel or the surrounding community. For some unit processes special safety precautions are required during operation. For other unit processes only normal safety precautions are required for operation. Therefore, two levels of safety are used in rating unit processes in this report: "special" and "normal".

Operators Required

This criterion is a measure of the relative number of operators and maintenance personnel required to successfully operate and maintain the unit process as compared to the reference unit process. For this study three levels of operators required are cited: "greater," which indicates a staff larger than the average required for the reference unit process; "average" number; or "fewer" number than average required to operate and maintain the reference unit process.

Operational Complexity

Operational complexity is defined as the degree of difficulty in the maintenance and control of a unit process. It is directly proportional to the level of skill required by plant operators to successfully operate the unit process. Average operational complexity means the unit process requires similar skills compared to the reference unit process. For this study three levels of operational complexity are cited: "difficult", "average," and "simple". The simple rated unit process will not require as high a skill level for operators in order to operate successfully. A difficult unit process will require more highly skilled operators compared to the reference unit process for successful operation.

Power Efficiency

Within each functional area power is required to achieve the desired degree of treatment. A unit process rated as "high" for power efficiency uses less power than the reference process to achieve similar degrees of treatment. A unit process rated "average" is similar in power needs to the reference process. A unit process rated as "low" for power efficiency uses more power than the reference process to achieve similar degrees of treatment.

Auxiliary Needs

Certain unit processes such as plant water for washing or chemical feed facilities, require significant auxiliaries to support the process. Needs were noted for these unit processes. If the unit process does not require any auxiliary equipment or utilities, the notation "none" was entered.

Residuals Aspects

Residuals aspects are defined as the level of difficulty of collection, processing, and disposal of residuals. Residuals include primary and secondary sludges, scum, grit, and screenings. This criterion takes into account both the quality and quantity of residuals generated by unit processes. A unit process rated "difficult" generates a greater amount of residuals or residuals more difficult to collect, process, or dispose of compared to the reference unit process. A unit process rated "average" is similar to the reference unit process in residuals aspects. A unit process rated "good" either generates less residuals compared to the reference unit process, or the collection, processing, and disposal of those residuals is less difficult than the reference unit process.

Spoils Disposal

Construction of unit processes will require excavation of soil and subsequent disposal at either on-island or off-island locations. Unit processes that require minimal excavation will reduce the volume of spoils requiring disposal. For this study spoils disposal is rated as "difficult" compared to the reference unit process, "average" if it is similar to the reference unit process, or "simple" if it produces significantly less spoils than the reference unit process.

Air Emissions Control

Air emissions control is defined as the potential for generating air emissions and therefore, indirectly, as an indication of the level of control necessary to limit air emissions from a unit process. Volatile material is emitted from nearly all unit processes. Production is greater where turbulence is greater. For these unit processes the level of control is greater to minimize the effects of these emissions.

For this study, a unit process rated "difficult" has a greater potential for emissions and requires a complex method to collect air emissions, or the area over which collection is required is extensive compared to the reference unit process. A unit process rated "average" emits a similar amount of pollutants and requires similar control as compared to the reference unit process. A unit process rated "none" does not produce significant air emissions and is not normally equipped with air emission control equipment.

Noise Control

Noise control is defined as the ease of controlling the noise generated during operation of a specific unit process. For this study, a unit process rated "difficult" has a potential for a high noise level and requires a greater level of control compared to the reference unit process. A unit process rated "average" produces noise and requires noise control mitigation to about the same degree as the reference project. A unit process rated "good" produces only low levels of noise that are simply controlled as compared to the reference unit process.

Aesthetics

Aesthetics is defined as the relative visual impact of a unit process on the surrounding communities and adjacent marine users. Unit processes are rated as either "good" or "average". A unit process ranked "good" is normally housed in a building where the building itself can be treated architecturally, or the process has a very low profile compared to the reference unit process. A unit process ranked "average" may have a high profile, may have a large amount of exposed equipment, or have other attributes that would require normal screening or other architectural treatment.

Effluent Quality

Effluent quality is defined as the relative impact of a unit process on downstream unit processes or the receiving water. A unit process rated "high" achieves results better than the reference unit process. A unit process rated "average" is similar to that achieved by the reference unit process. A unit process rated "low" does not meet the same standards as the reference unit process.

4.4 DETAILED EVALUATION CRITERIA

As part of the Secondary Treatment Facilities Plan development, major decisions will be made to select a wastewater treatment process; to size and locate conduits and pumping stations to convey wastewater to, and treated effluent from, the Deer Island Treatment Facility; and to plan the initial site preparation program at Deer Island. The purpose of this section is to describe the criteria that will be used to evaluate alternatives. These criteria include the criteria used during earlier screening of unit processes as well as additional criteria applicable to the detailed analysis. Evaluation criteria for outfall selection will be finalized at a later date following discussions with interested parties. Evaluation criteria for residual management and combined sewer overflows are subjects of separate facilities plans.

The remaining project components include the plant, the inter-island wastewater conduit, and site preparation. Certain criteria are common to all of the project components. They are presented in Section 4.4.1.

Sections 4.4.2 through 4.4.4 describe criteria specifically applicable to each of the other project components as follows:

Section 4.4.2 Specific Criteria for Evaluation of Wastewater Treatment Alternatives

Section 4.4.3 Specific Criteria for Evaluation of Inter-island Wastewater Transport System Alternatives

Section 4.4.4 Specific Criteria for Evaluation of Site Preparation Alternatives

Specific criteria for the evaluation of Effluent Outfall alternatives will be discussed in Volume V, Effluent Outfall.

The description of these criteria will enable the reader to understand how a particular criterion will be used to rate an alternative. No weighting factors have been assigned to any of the criteria. The alternatives will not be ranked. Rather, the criteria will be used to display sufficient information about each alternative so that decisions can be made in selecting the recommended plan.

Tables 4.4.5-1 and 4.4.5-2 describe how the criteria used during the siting of this plant and MWRA's previous commitments to mitigation are incorporated in the evaluation criteria.

TABLE 4.4-1
SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF ALTERNATIVES

Criteria	Wastewater Treatment Plant	Inter-Island Conveyance	Early Site Preparation	Indicators
	PROJECT COMPONENTS			
COST				
Present Worth Costs	X	X	X	Millions of Dollars
Capital Costs	X	X	X	Millions of Dollars
Annual Operation and Maintenance Costs	X	X		Millions of Dollars Per Year
TECHNICAL				
Area Requirements	X	X	X	Acres
Reliability	X	X		Acceptable, High
Flexibility	X	X	X	Acceptable, High
Constructibility	X	X	X	Aggravated, Moderate, Minimal
Personnel Safety	X			Special, Typical
Staffing Requirements	X			Number of Personnel
Operational Complexity	X			Difficult, Modest Typical
Power Needs	X		X	Millions of Dollars Per Year

TABLE 4.4-1
SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF ALTERNATIVES
(continued)

Criteria	PROJECT COMPONENTS			
TECHNICAL (cont)	Wastewater Treatment Plant	Inter-Island Conveyance	Early Site Preparation	Indicators
Chemical Requirements For Operation	X			Pounds per Day by Type
Quantity of Residuals Generated	X			Tons Per Day
Quality of Residuals Generated	X			Difficult, Modest, Typical
Quantity and Quality of Spoils	X	X	X	Cubic Yards
ENVIRONMENTAL				
Air Emission Control	X	X	X	Volume Requiring Treatment
Noise Control	X	X	X	Difficult, Modest, Minimal

TABLE 4.4-1
SECONDARY TREATMENT FACILITIES PLAN
PROPOSED CRITERIA FOR DETAILED EVALUATION OF ALTERNATIVES

Criteria ENVIRONMENTAL (cont)	Wastewater Treatment Plant	Inter-Island Conveyance	Early Site Preparation	Indicators
	PROJECT COMPONENTS			
Traffic	X	X	X	Number of Truck Trips per day or Significant, Modest, Minimal
Marine Resources		x	x	Significant, Modest, Minimal
INSTITUTIONAL				
Timely Implementation	X	X	X	Difficult, Modest
Permitting	X	X	X	Extensive, Modest
External Coordination	X	X	X	Extensive, Modest Minimal
Internal Coordination	X	X	X	Extensive, Modest Minimal
Demand for Unique or Scarce Resources	X	X	X	Difficult, Modest
Flexibility to Meet Project Phasing			X	None, Fair, Good

4.4.1 COMMON EVALUATION CRITERIA

The evaluation criteria that are common to all project components are as follows:

Air Emissions Control

Air emissions control is defined as the potential for generating odor/air emissions and therefore, indirectly, as an indication of the level of control necessary to limit air emissions from wastewater treatment, transport and site preparation activities. For each alternative, the total volume of air requiring treatment will be estimated. The ambient concentration of emissions including odors and their impact on plant personnel and neighboring communities will also be evaluated in accordance with State guidelines.

Noise Control

MWRA has committed to a program to comply with stringent noise mitigation and to develop a program to avoid adverse noise impacts during construction and operation. Since all alternatives will meet these commitments this criterion is defined as the ease of controlling the noise generated during construction and operation. Wastewater project component alternatives rated "difficult" have a potential for high noise levels and require a greater level of control. An alternative rated "modest" produces noise and requires noise control mitigation to about the same degree as typical wastewater transport and treatment facilities or as typical site preparation projects. Alternatives may be rated "low" if little or no noise control is required.

Environmental

This set of criterion measures a project component's effect on selected environmental items. The list below is based on EPA guidance for facilities planning. Each alternative will be evaluated (where applicable) for impacts to:

- o Historical and archaeological sites
- o Floodplains, wetlands and barrier beaches
- o Fish and wildlife protection
- o Endangered species protection
- o Recreational opportunities

Alternatives will be rated as having "minimal", "modest", or "significant" effect.

Traffic

MWRA has committed to limit the traffic through Winthrop during both construction and operation of the treatment facilities. As a major element of that committment the MWRA is in the process of contracting a pier facility for the movement of materials by either barging or Roll/On-Roll/Off. Where differences exist among alternatives in the amount of equipment or materials to be transported to the site, the

number of trick trips and/or barge trips for personnel, materials, and equipment during construction will be estimated. Differences will also be shown for the number and type of trips required during operation.

Area Requirements

For each project component, alternative preliminary layouts will be prepared. For the wastewater treatment alternatives, all processes require multiple units, therefore, the space between processes will be taken into account in determining total process area. Areas for ancillary facilities, roadways and interprocess conveyance will be added to the process area. For other project components (transport, outfall and site preparation), area requirements for alternatives will also be presented.

Quantity and Quality Of Spoils for Disposal and/or Relocation

Construction of new transport and treatment facilities will require the movement of large quantities of soil and its subsequent disposal/use at either on-island or off-island locations. For this study, the total volume (cubic yards) of spoils requiring movement and the volume (cubic yards) requiring offsite disposal and/or reuse will be presented for each alternative. In addition, material that will require offsite disposal will be assessed as to the type and quality of material and the difficulty expected in ultimately disposing of this material.

Timely Implementation

Implementation is defined as the relative difficulty expected in maintaining the schedule for installation and/or expansion of the system in discrete, manageable components. For this study, two ratings are appropriate for this criteria: "moderate" and "difficult". For alternatives with features likely to make implementation difficult or to cause project delays, the "difficult" rating is used. For other alternatives with fewer challenges, the "moderate" rating is used.

Permitting

Permitting is defined as the measure of the relative difficulty in obtaining the necessary permits for an alternative. The alternatives will be rated "moderate" or "extensive" reflecting the relative time required to obtain a permit.

External Coordination Requirements

External coordination requirements are a measure of the relative degree to which the Authority must interact with other organizations to achieve the desired objectives. This includes consideration of legislative approval and other requirements necessitated by legal and jurisdictional limits to MWRA's authority. Alternatives are rated "minimal", "modest" or "extensive" depending on the degree of coordination required.

Internal Coordination Requirements

Internal coordination requirements are a measure of the relative degree of coordination required between Authority projects or programs such as the coordination required between the wastewater treatment section

and the industrial waste section. Alternatives are rated "minimal", "moderate" or "extensive" depending on the degree of coordination required.

Demand For Unique Or Scarce Resources

This criterion is a measure of the demand that any one alternative may put on resources that are in scarce supply or not available in the local area. Key shortages of some labor skills and equipment may occur because of the concurrent construction of major projects such as the third harbor tunnel. Alternatives are rated "moderate" if potential conflicts exist, or "difficult" if demands clearly exceed supply.

Present Worth Costs

Present worth costs are the sum of those costs which, if invested now at a given interest rate, would provide exactly the funds required to construct and operate the project for the planning period. Present worth costs for each project component alternative will be presented in terms of millions of dollars. The design year of the project is 2020, twenty years after the planned startup of secondary treatment facilities and 25 years after the planned startup of new primary treatment facilities.

Capital Costs

Capital costs of alternatives will include costs to construct facilities, costs for equipment replacement during the planning period plus 35 percent to cover construction contingencies, administrative, engineering and legal costs. Any significant and special mitigation cost will be included in the alternative costs. Construction costs of necessary facilities in this plan do not include costs for land purchase. Financing, legal and administrative costs to implement the project will be presented only for the recommended plan. Capital costs will be presented in terms of millions of dollars.

Annual Operation And Maintenance Costs

Operating costs will include power, labor, chemical and utility costs and the cost of supplies. Power costs will include consideration of power company demand charges and credit for power produced on-site. Labor costs will be based on average salary levels including employee benefits. Annual operation and maintenance costs will be presented in terms of millions of dollars per year.

4.4.2 SPECIFIC CRITERIA FOR EVALUATION OF WASTEWATER TREATMENT ALTERNATIVES

The specific evaluation criteria that will be used for evaluation of treatment alternatives are described below.

Reliability/Flexibility

Reliability/Flexibility is defined as the degree to which a wastewater treatment alternative will accomodate an anticipated upset or a significant, generally unanticipated, equipment failure and still meet treatment standards. Overall flexibility will be a function of the design criteria selected for individual unit processes. This criterion is judged using the existing record of municipal wastewater experience and performance for individual unit process. Wastewater treatment alternatives are rated using one of two levels of reliability/flexibility: "acceptable" and "high". An alternative ranked "high" consistently achieves and frequently exceeds the required degree of treatment. An alternative ranked "acceptable" can be expected to have occasional process upsets but will continuously meet standards.

Constructibility.

Constructibility takes into account many aspects of the construction of treatment facilities. These include the degree of construction difficulty, construction duration, and impacts on overall scheduling. Construction work will be divided up into appropriate packages depending on factors such as special labor skills required, degree of instrumentation or mechanical equipment installation. The number of work packages or contracts may impact the project schedule. For this study, wastewater treatment alternatives are rated as presenting "aggravated" conditions for construction, or as presenting "minimal" conditions for construction.

Personnel Safety

Safety is a criterion used to judge the level of precautions needed to reduce risks to plant personnel or to the surrounding community. For some unit processes special safety precautions are required during operation. For other unit processes only normal safety precautions are required for operation. Therefore, two levels of safety are used in rating unit processes in this report: "special" and "typical".

Staffing Requirements

This criterion identifies the approximate number of operators and maintenance personnel required to successfully operate and maintain a particular alternative wastewater treatment process. Management, supervisory and laboratory personnel needs will be about the same for each alternative and will be estimated for the recommended plan.

Operational Complexity

Operational complexity is defined as the degree of difficulty in the maintenance and control of a unit process. It is directly proportional to the level of skill required by plant operators to successfully operate the unit process. Average operational complexity means the unit process requires similar skills as compared to the reference unit process. For this study three levels of operational complexity are cited: "difficult", "modest", and "typical". The "typical" rated unit process will not require as high an operator skill level for successful operation. A "difficult" unit process will require more highly skilled operators to achieve successful operation compared to the reference unit process.

Power Needs

Within each functional area power is required to achieve the desired degree of treatment. (Preliminary treatment, primary treatment, secondary treatment and clarification, disinfection, and influent and effluent pumping.) For each alternative the total power required will be presented in kilowatts.

Quantity of Residuals Generated

Residuals refer to the sludge, screenings, grit and scum removed from the wastewater during treatment. These residuals require processing and disposal. For each alternative the total weight or volume of residuals, by type, will be presented.

Quality of Residuals Generated

Since all wastewater treatment alternatives treat the same influent, the quality of residuals generated will be generally similar. However, different unit processes may remove residuals in a manner that affects their characteristics. This may impact the degree of difficulty in processing or disposing of residuals. For this criterion, a unit process that generates residuals that are more difficult to manage than those of a typical secondary treatment facility will be identified. The three levels of residuals quality cited are "typical" and "difficult".

Chemical Requirements for Operation

For those alternatives requiring chemicals, the type and quantity will be presented. THE quantity will be presented in terms of pounds per day, or in other appropriate measurements. Hazardous chemicals will be identified and chemical requiring any special handling will be identified.

Visual Impacts

This criterion addresses the visual impact of the wastewater treatment facilities both at deer island and the headworks facility at nut island. The current profile of Deer Island includes the central drumlin which rises 100 ft above water level, the existing plant, the prison, and other natural and manmade features. The current profile of Nut Island is dominated by the existing plant. The visual impact is assesed as resulting in "minimal", "modest" or "significant" change to the Islands. At Deer Island the impact is evaluated from several points of view: the nearby residents of Point Shirley; the more distant residents of the town of Winthrop; and a view from the west or southwest which could represent a view

from Boston or from marine users of Boston Harbor. At Nut Island the impact is evaluated from Hough's Neck and the Quincy shoreline.

Flexibility to Meet Future Changes

This criterion evaluates the wastewater treatment alternatives according to the relative ease with which they could be modified to accommodate future changes in treatment standards. The ease of adaptation is assessed as either "none", "fair" or "good".

4.4.3 SPECIFIC CRITERIA FOR EVALUATION OF INTER-ISLAND WASTEWATER TRANSPORT SYSTEM ALTERNATIVES

In this section, evaluation criteria that will be used in the detailed evaluation of inter-island wastewater transport system alternatives will be described. The major alternatives being studies are a buried pipeline, a deep rock tunnel, or a combination of methods that will transport wastewater from the Nut Island headworks facility to the Deer Island plant.

<u>Reliability</u>

Reliability is defined as the level of assurance that the inter-island wastewater transport system will continuously operate over the expected range of operating conditions throughout the life of the project. Reliability is a criterion in selecting and arranging active components of the system such as electrical and mechanical equipment. Reliability is not a criterion in selecting and arranging passive components of the system such as structures, buried pipelines, and tunnels.

The reliability of pumping station equipment alternatives are rated using two levels: "acceptable" and "high". Alternatives ranked "high" are expected to operate continuously without system impact. Alternatives ranked "acceptable" can be expected to have infrequent equipment outages. In all cases, however, back-up pumping capacity will be available from standby units.

<u>Flexibility</u>

Flexibility is defined as the degree to which a hydraulic transport system alternative will accommodate an upset or a significant, generally unanticipated, equipment failure. An upset condition may be defined as other than normal, but anticipated. For this study, alternatives are rated using one of three levels of flexibility: "low" or "medium" or "high". Alternatives ranked "high" are not significantly affected by upset conditions. Alternatives ranked "medium or "low" are sometimes affected by these conditions but will meet standards.

<u>Constructibility</u>

Constructibility is defined as the level of assurance that the inter-island transport system will be constructed on schedule. Constructibility is a criterion used in evaluating the transport conduit alternatives: buried marine pipeline versus deep rock tunnels. This criterion includes availability of labor skills, equipment and materials; proven, as opposed to state-of-the-art, construction methods; and the impact of adverse weather. Alternatives are discribed as having "minimal", "moderate" or "aggravated" conditions for construction.

<u>Marine Resources</u>

Potential impacts to marine resources associated with the construction of alternative inter-island wastewater transport systems will be compared. In general, those alternatives

involving construction within the marine environment may be characterized as having a "minimal," "modest" or "significant" potential for either short- and/or long-term impact to the affected resources. Impacts may be direct, such as displacement of biota or removal of benthic habitat by dredging or by marine spoil disposal, or impacts may be indirect to the marine biota by releasing potentially toxic constituents.

4.4.4 SPECIFIC CRITERIA FOR EVALUATION OF SITE PREPARATION ALTERNATIVES

The following sections described the specific evaluation criteria that will be used during the detailed evaluation of site preparation alternatives. Site preparation is defined as those construction activities required at Deer Island (e.g. removal of central drumlin, prison facilities, bunkers) before the new primary treatment facilities are constructed.

Flexibility

Flexibility is defined as the degree to which site preparation activities do not preclude the feasability of possible options for engineering, construction and operation of existing and proposed treatment facilities. Alternatives ranked "high" offer the greatest flexibility, i.e., the fewest restraints. Alternatives ranked "acceptable" indicate reduced flexibility. Alternatives rated as "limited" indicate significantly reduced ability to accomodate engineering options.

Constructibility

Constructibility takes into account many aspects of site preparation including the degree of construction difficulty, duration, access requirements, sequencing, and scheduling. Construction work will be broken into appropriate packages depending on special labor skills required and phase of work. For this study, site preparation alternatives are rated as presenting "minimal", "modest" or aggravated" conditions for construction.

Power Needs

Power is required to support site preparation alternatives. While the quantity of power required for site preparation is small in comparison to the ultimate pumping and treatment power needs, the demand may exceed the limited onsite supply. Thus, an offsite power supply, which currently doesn't exist, may be required early in the project. This criteria judges the amount of power required and the date by which it is required.

Quantity and Quality of Spoils for Disposal and/or Relocation

Construction of new transport and treatment facilities will require the movement of large quantities of soil and its subsequent disposal/use at either on-island or off-island locations. For this study, the total volume (cubic yards) of spoils requiring movement and the volume (cubic yards) requiring offsite disposal and/or reuse will be presented for each alternative. In addition, material will require offsite disposal will be assessed as to the type and quality of material and the difficulty expected in ultimately disposing of this material.

Special Resources

Site preparation may require the removal or relocation of special resources such as historic structures and archaeological resources. An alternative which minimizes removal and maximizes reuse/relocation of resources that are removed is described as "minimal". An alternative which may require more infringement of these resources is described "modest". An alternative that requires significant infringement on these resources is described "significant".

Flexibility to Meet Project Phasing

This criterion evaluates the site development alternatives according to the relative ease with which they could be modified to accomodate larger area requirements for wastewater treatment as dictated by changes in treatment standards. The ease of adaptation is assessed as either "none". "fair" or "good".

4.4.5 APPLICABILITY OF OTHER CRITERIA AS DETAILED EVALUATION CRITERIA

During siting of the wastewater treatment plant, the MWRA developed eight criteria to assist in site selection. Table 4.4.5-1 provides a description of each siting criteria and a statement of its applicability for use as evaluation criteria.

A significant mitigation package was developed as an integral part of MWRA's decision to site the new secondary treatment facilities on Deer Island. Because the MWRA is committed to alleviating the impacts associated with the construction and operation of the treatment facilities, the previous mitigation commitments are also an integral part of the facilities planning process.

Table 4.4.5-2 provides a summary description of each of the mitigation commitments, and a statement of the applicability of each commitment for use as an evaluation criterion.

TABLE 4.4.5-1

APPLICABILITY OF PLANT SITING CRITERIA
AS EVALUATION CRITERIA

SITE SELECTION CRITERIA	APPLICABILITY OF CRITERIA
1. Reliability	
Measures the ability of each alternative to promote the overall integrity of the wastewater treatment system.	Reliability considerations are included in treatment, inter-island transport, and outfall evaluation criteria.
2. Effect on Neighbors	
Measures each alternative's impact on those in close proximity to the treatment plant and on those impacted by the construction of the facility. Impacts analyzed were odor, noise, property values and health and safety.	Odors, noise, visual affects and health and safety considerations are included in evaluation criteria for the pertinent project components. The remaining considerations are discussed in the section on mitigation commitments.
3. Equitable Distribution Of Regional Responsibility	
Measures the degree to which any one community is asked to shoulder a disproportionate share of the impacts associated with living and working in a major metropolitan area.	This criterion is not considered for the project components involving treatment wastewater transport to Deer Island, and site preparation. It may be used in development of outfall siting criteria.

TABLE 4.4.5-1

APPLICABILITY OF PLANT SITING CRITERIA
AS EVALUATION CRITERIA
(continued)

SITE SELECTION CRITERIA	APPLICABILITY OF CRITERIA
4. Cost	
Measures the financial resources that must be invested in the facility under each alternative.	Costs criteria are described and considered in all project components.
5. Implementability	
Measures the ability of each alternative to be brought to reality in a timely and predictable manner. This criterion considered construction schedules, the permitting process, and other institutional aspects.	Implementation and permitting are considered in all project components.
6. Harbor Enhancement	
Measures each alternative's consistency with, and potential for, improvement of Boston Harbor's role in the economic and social life in the Greater Boston area. This criterion was used to judge which harbor island had a greater potential for recreational opportunities.	Harbor enhancement is the goal of all the alternatives considered but is not specifically included in the evaluation criteria.
7. Effect On Natural And Cultural Resources	
Measures each alternative's effect on important resources in the harbor. This criterion was used to weigh the relative importance of historic and archaeologic sites and barrier beaches and wetlands on the candidate harbor islands.	These considerations are described and considered in all project components.

TABLE 4.4.5-1

APPLICABILITY OF PLANT SITING CRITERIA
AS EVALUATION CRITERIA
(continued)

SITE SELECTION CRITERIA	APPLICABILITY OF CRITERIA
8. Mitigation A significant mitigation package was developed as an integral part of MWRA's decision to site the new secondary treatment facilities on Deer Island. MWRA is committed to alleviating the impacts associated with the construction and operation of the treatment facilities.	The next section discusses each mitigation commitment and its applicability as an evaluation criterion for alternatives.

TABLE 4.4.5-2

APPLICABILITY OF COMMITMENTS TO MITIGATION
AS EVALUATION CRITERIA

MITIGATION COMMITMENTS	APPLICABILITY OF COMMITMENTS
1. Flow and Growth	
MWRA has committed to an aggressive program to avoid overloading the new treatment facilities planned for Deer Island, and to avoid future expansion to the extent possible. MWRA will implement flow management techniques as well as a program to avoid excess pollutant loading. If necessary, future considerations may include flow control structures and satellite treatment plants to minimize peak flows.	Estimates of wastewater flow and pollutant loading have been employed as the basis for wastewater transport, treatment, and outfall project components. Since this commitment will be implemented independently of all alternatives being considered, it is not used as an evaluation criterion. It is the subject of a separate analysis in the facilities plan.
2. Operations and Maintenance	
MWRA is committed to improved operations and maintenance. The facilities plan will initiate early planning of operations and maintenance considerations.	Operations and maintenance considerations are included in evaluation criteria and are pertinent to transport, treatment, and outfall project components.
3. Odor Control	
MWRA is committed to the construction of a facility that will control odors: to eliminate detectable odors offsite, protect the public health, and to minimize, to the extent feasible, objectionable odors onsite.	Criteria for odors and other air emissions are considered in all project components.

TABLE 4.4.5-2

APPLICABILITY OF COMMITMENTS TO MITIGATION AS EVALUATION CRITERIA (continued)

MITIGATION COMMITMENTS	APPLICABILITY OF COMMITMENTS
4. Noise Control	
MWRA has committed to compliance with all legal standards and has set a noise abatement goal that goes beyond simply adhering to applicable codes. MWRA will examine noise abatement throughout the planning, design, construction and operation of the facility to avoid adverse noise impacts. MWRA will also establish an acoustic review board and will solicit community involvement in the noise control program.	Criteria for noise control are considered in all project components.
5. Barging and Busing	
MWRA is committed to the priority of the construction of on-island piers and to limit trucking volume during pier construction; upon completion of pier facilities, to barge almost all heavy construction equipment and materials with a limited level of contingency trucking; bus all construction workers; and investigate the practicality of providing ferries to transport construction workers.	Since this commitment will be implemented independently of all alternatives being considered, it is not used as an evaluation criterion. Special transportation needs are included as an evaluation criterion as regards construction support needs.
6. Trucking of Liquid Chlorine	
MWRA has committed to cease the trucking of liquid chlorine through Winthrop immediately after site access facilities and feasible barging become available.	Since this commitment will be implemented independently of all alternatives being considered, it is not used as an evaluation criterion.

TABLE 4.4.5-2

APPLICABILITY OF COMMITMENTS TO MITIGATION AS EVALUATION CRITERIA (continued)

MITIGATION COMMITMENTS	APPLICABILITY OF COMMITMENTS
7. Relocation of Deer Island House of Correction	
MWRA has determined that the Deer Island House of Correction must be relocated.	Since this commitment will be implemented independently of all alternatives being considered, it is not applicable for use as an evaluation criterion.
8. Further Measures To Be Examined	
EOEA, in its final certification, recommended that MWRA consider earlier implementation of certain additional measures. Within this facilities plan, MWRA will further examine VOC's and air toxic controls. MWRA will examine other suggestions such as the concept of a "sewer bank", the utilization of satellite plants, additional flow measurements, odor panel formation, odor monitoring, and formation of an acoustic review board.	Air emission control and noise considerations are considered in all project components. Other considerations will be independent of all alternatives being considered and therefore are not used as evaluation criteria.

4.5 GUIDELINES FOR COST EVALUATION

In order to use cost-effectiveness comparisons of the treatment alternatives considered for detailed analysis. these guidelines for unit process cost evaluation and procedures for determining life-cycle costs have been developed based on EPA cost-effectiveness guidelines. Common parameters to be used in all cost effectiveness comparisons include design lives. discount rate. salvage values. and base year for analysis.

Life-cycle cost factors have been prepared for the outfall project. the inter-island conveyance project. the design and construction of the primary treatment facilities. and the design and construction of the secondary treatment facilities due to the phased construction. The derivation of these factors and the common parameters used in the development of these factors are explained in the following paragraphs.

4.5.1 DISCOUNT RATE

At the start of each fiscal year. EPA establishes the discount rate to be used for life-cycle cost analyses. The rate to be used for this analysis is 8-5/8 percent. the rate established by the Water Resources Council as of October 1. 1985.

Several of the events on the life-cycle cost diagram do not occur at one year intervals. Because of this. the life-cycle cost analysis factors generated for the facilities planning have been developed using a monthly discount rate of 0.71875 percent (8-5/8 percent divided by 12). and payments have been divided into monthly periods.

4.5.2 BASE YEAR AND PLANNING PERIOD FOR ANALYSIS

The base month selected for the cost analysis is January. 1990. The year 1990 represents the first year of projected construction activity for primary treatment facilities. Although the projected start-up for construction is not until July of that year. it was considered much easier to use the beginning of the year as a base rather than seven months into the year.

The end of the life cycle of the project will be January. 2020. This provides for 20 years of operation of the completed secondary treatment facilities.

4.5.3 CONSTRUCTION COST INDEX

The construction costs used for based on September. 1986 prices. The Construction Cost Index. as presented in the Engineering News Record (ENR-CCI) for September. 1986. is 4332.5. To simplify. use 4330 for the baseline cost index.

4.5.4 COST ESCALATION FACTORS FOR ENERGY USE AND WASTEWATER FLOW INCREASES

There will be no escalation of energy or chemical costs for the purposes of the

cost-effectiveness comparisons. Cost escalation for energy and chemicals will be considered as part of a sensitivity analysis. Different rates will be used to determine potential impacts on total present worth costs of the relative ranks of alternatives. None of the costs will be weighted according to flow. It is unlikely that one alternative would have an appreciably higher flow-dependent cost than another. In addition, the average flow in 1986 is approximately 93 percent of the ultimate average flow. This difference in flow is not enough to warrant a difference in number of staff. And the difference in energy and chemical requirements would not be appreciable.

4.5.5 LIFE EXPECTANCIES

The life expectancies of cost items are important for use in determining future replacement costs and salvage values at the end of the project period. The life expectancies to be used for these projects are as follows: 5 years for vehicles; 15 years for all equipment; and 50 years for buildings, structures, and pipelines.

4.5.6 LAND COSTS

The MWRA either owns or is statutorily permitted to use all land on Deer Island. The cost of land is not expected to become a part of the life cycle cost analysis. The land requirements are independent of the treatment process selected since all excess area will serve as a buffer zone. Also, in accordance with the cost effectiveness guidelines, the land values must be salvaged at the end of the planning period and therefore would be negligible in the final cost effectiveness comparison. Therefore, there is no need to consider land costs in the life-cycle cost analysis.

4.5.7 PROJECT COSTS

The term "project cost" is used throughout the discussion of cost factors. This cost consists of the estimated capital construction cost plus the cost of engineering and contingencies. The sum of engineering and contingency costs was estimated to be 35 percent of the installed cost. In other words, the estimated installed cost of an item will be multiplied by a factor of 1.35 to yield the project cost.

4.5.8 INTEREST DURING CONSTRUCTION

Interest during construction was calculated based on the following:

- o Uniform cash flow over construction period (therefore, constant gradient of interest payments)
- o Discount rate of 8-5/8 percent per year
- o Monthly payments of interest due

- o No investment dividends on borrowed money not yet paid on the project

- o Gradient series of interest payments converted to annual and then present worth cost

4.5.9 ANNUAL COST

Annual costs are those costs paid each year to keep the facilities in good operating order and to preserve the lives of structures and equipment. The following items, among others, are included:

- o Wages and salaries

- o Maintenance items

- o Energy consumption

- o Chemicals

The labor cost for the plant's operation and maintenance staff, including fringe benefits, averages $30,000 per year. The annual maintenance cost which includes lubrication oils, replacement parts, and other maintenance items, is estimated at one percent of the equipment capital costs. The cost of electric power is $0.055/kwh. Chemical costs for the biological treatment alternatives include gaseous hydrochloric acid for cleaning the diffuser discs of the fine bubble diffused air and coupled system alternatives. Chemicals are also required for the disinfection alternatives. For one alternative, sodium hypochlorite must be purchased, while for onsite sodium hypochlorite generation, nitric acid is used for cleaning the generation cells. For the two disinfection alternatives using sodium hypochlorite, dechlorination may be determined necessary. If this is the case, then gaseous sulfur dioxide would have to be purchased. The unit costs for the hydrochloric acid is $65 per ton. The unit cost for the sodium hypochlorite is $0.35 per gallon: $7.10 per gallon for the nitric acid: and $0.15 per pound of sodium dioxide.

4.5.10 BASIS OF COST COMPARISON

All cost comparisons are made in terms of present worth costs instead of equivalent annual costs. This has been done to avoid confusion between equivalent annual costs and annual operating and maintenance costs. Present worth costs provide a convenient method to evaluate one time capital costs and the annual costs of the alternatives on an equivalent basis. Relative rankings of alternatives will not change whether present worth or equivalent annual cost is the method of comparison.

Table 4.5.10-1 has been prepared with both 1990 and the start-up date of the individual item as

base years. Present worth factors at the start-up date have been prepared because in the case of secondary treatment, translating future costs to present worth makes them appear deceptively low.

TABLE 4.5-1
SUMMARY OF LIFE-CYCLE COST FACTORS

Item	Factor For Present Worth at Base Year-January 1990
Outfall Project	0.7700 Cout +6.996 Aout
Harbor Tunnel Project	0.7633 Ctun +6.664 Atun
Primary Treatment Facilities Project	0.94234 Cpe +0.7608 Cps +2.0069 Cpv +6.3466 Ap
Secondary Treatment Facilities Project	0.6070 Cse +0.4954 Css +1.0301 Csv +4.029 As

Notes:

1. Final Project Month = January, 2020
2. Discount Rate = 0.71875% per month (based on 8-5/8% per year)
3. Abbreviations
   - Cout Project Cost of Outfall
   - Aout Annual Maintenance Cost for Outfall
   - Ctun Project Cost of Harbor Tunnel
   - Atun Annual Maintenance Cost For Harbor Tunnel
   - Cpe Project Cost of Primary Treatment Equipment
   - Cps Project Cost of Primary Treatment Buildings Structures, and Pipelines
   - Cpv Project Cost of Primary Treatment Vehicles
   - Cse Project Cost of Secondary Treatment Equipment
   - Css Project Cost of Secondary Treatment Buildings, Structures, Pipelines
   - Csv Project Cost of Secondary Treatment Vehicles
   - Ap Annual Operations and Maintenance Cost for Primary Treatment
   - As Annual Operations and Maintenance Cost for Secondary Treatment
4. Life Expectancies

Equipment	15 Years
Buildings, Structures, Pipelines	50 Years
Vehicles	5 Years

Section 5

5.0 EXISTING FACILITIES

5.1 TREATMENT FACILITIES

This section presents a description of the current wastewater treatment facilities and the ongoing program to upgrade the existing Deer Island and Nut Island Wastewater Treatment Plants and the existing headworks on the North Metropolitan Sewer System. Solids-handling-related facilities are the subject of a separate facilities plan and are not specifically addressed as part of this description. The on-going rehabilitation program, called Fast-Track Improvements, is intended to provide reliable treatment until existing facilities are replaced or improved during construction of the new primary plant.

The Deer Island and Nut Island treatment plants, the Winthrop Terminal at Deer Island, and the three remote headworks on the North Metropolitan System were visited between August 18, 1986 and September 25, 1986. During these visits, photographs were taken, operators were interviewed, major equipment was inspected and inventoried, and current conditions and methods of operations were reviewed. As part of the on-site visits, a number of contract documents pertaining to the existing facilities were obtained. Detailed results of these inspections are presented in a report titled On-Site Inspections and Existing Operations, March 5, 1987.

The MWRA's wastewater collection system consists of a North System and a South System. North System flows are collected and transported to the Deer Island Treatment Plant. South System flows are collected and transported to the Nut Island Treatment Plant.

5.1.1 NORTH SYSTEM

Influent flow enters the Deer Island plant through both the Main Pumping Station and the Winthrop Terminal Headworks.

The Main Pumping Station at Deer Island can pump from either of two deep rock tunnels, each constructed 300 feet below sea level. The first tunnel, the Boston Main Drainage Tunnel, is approximately 7 miles long. It crosses under Boston Harbor from Deer Island to South Boston where it connects to the Columbus Park Headworks. The Boston Main Drainage Tunnel continues from Columbus Park to the Ward Street Headworks located off Huntington Avenue, near the Wentworth Institute of Technology. The second rock tunnel, the North Metropolitan Relief Tunnel, is approximately 4 miles long. It connects the Chelsea Creek Headworks to the Main

Pumping Station at Deer Island. The Main Pumping Station has no wet well and the two tunnels are not connected. Each pump can draw from either tunnel, and suction connection to each tunnel is controlled by motor operated butterfly valves.

The Winthrop Terminal Headworks screen and pump influent flow that arrives at Deer Island via the North Metropolitan Trunk Sewer. This sewer is the original interceptor to Deer Island and is roughly paralleled by the North Metropolitan Relief Tunnel. The North Metropolitan Trunk Sewer receives flows from Winthrop, Orient Heights, and Deer Island, and overflows from the Chelsea Creek Headworks via the East Boston Pumping Station. The North Metropolitan Trunk Sewer has a peak capacity of 125 mgd. The Winthrop Terminal was designed to screen this entire flow and to provide grit removal for 60 mgd. Flows receiving grit removal are discharged to the primary plant. Flows in excess of the capacity of the grit system are discharged directly to the Deer Island Plant bypass.

The North System components are shown schematically in Figure 5.1.1-1. During peak flows, normally caused by wet weather flows from the numerous combined sewers of the North Metropolitan System, the Boston Main Drainage and North Metropolitan Relief Tunnels are selectively throttled at the three remote headworks, thereby diverting flows in excess of the plant's capacity to combined sewer overflows.

When the Ward Street Headworks is throttled, the majority of excess flow is diverted to the Cottage Farm Chlorination Facility which discharges to the Charles River.

When the Columbus Park Headworks is throttled, the majority of excess flow is diverted to the Calf Pasture Pump Station, located at Columbia Point, which pumps the wastewater to the Moon Island Outlet which discharges to Dorchester/Quincy Bay.

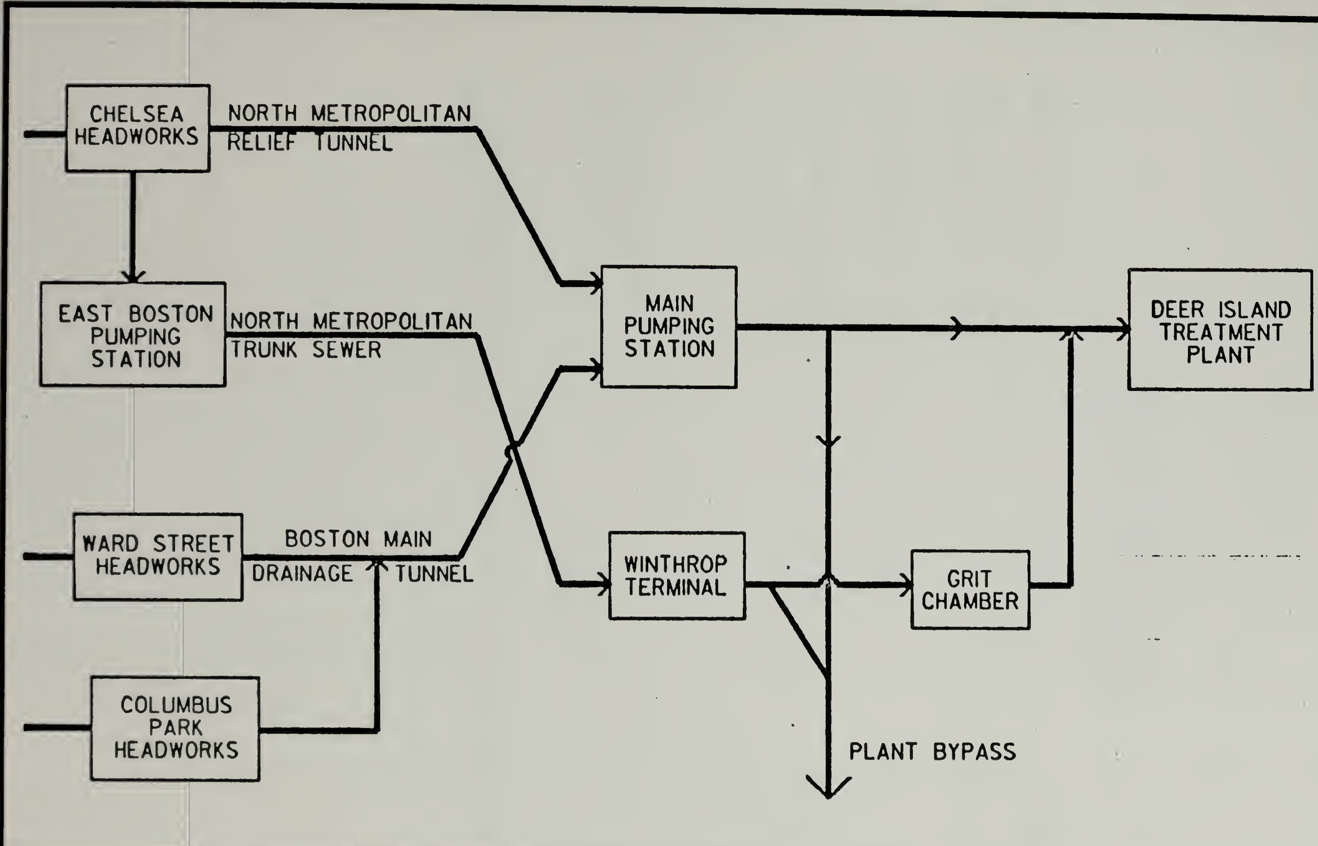
At Chelsea Creek, excess flow is diverted, via a siphon, across the creek to the East Boston Pump Station and is pumped from there into the North Metropolitan Trunk Sewer.

The north system is operated to maximize the flow from both the Chelsea Creek Headworks and the inter-connected Winthrop Terminal Headworks/East Boston Pump Station System. Because flow from Chelsea Creek Headworks is optimized, the system initially throttles flow at either the Columbus Park Headworks or Ward Street Headworks.

The hydraulic capacities of the existing major conveyance facilities in the North and South Systems are presented in Table 5.1.1-1.

5.1.2 SOUTH SYSTEM

The South Metropolitan Sewerage System's High Level Sewer conveys wastewater to the Nut Island Treatment Plant in Quincy. There are no remote headworks on the South Metropolitan Sewerage System. The High Level Sewer is fed by various upstream interceptors and force mains.



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.1.1-1
NORTH SYSTEM
HEADWORKS AND TUNNEL SCHEMATIC

TABLE 5.1.1-1
HYDRAULIC CAPACITY OF MAJOR
NORTH AND SOUTH METROPOLITAN
CONVEYANCE FACILITIES

North Metropolitan System	Size of Line	Peak Capacity (mgd)
Boston Main Drainage Tunnel Deer Island P.S. to Columbus Park Segment	11 ft - 6 in	438
Boston Main Drainage Tunnel Columbus Park to Ward St. Segment	10 ft	256
North Metropolitan Relief Tunnel	10 ft	350
North Metropolitan Trunk Sewer	108 in	125
Total Capacity to Deer Island		913
South Metropolitan System		
High Level Sewer	11ft-3in x 12ft-6in (maximum)	360[(1)]

(1) Maximum capacity based on unconstrained hydraulic conditions at Nut Island Plant. (See Section 8, Flows and Loads)

The South Metropolitan Sewerage System consists of a network of approximately 78 miles of MWRA interceptor sewers, five pump stations which are owned and maintained by the MWRA, and the existing Nut Island treatment plant.

The High Level Sewer (HLS), begins in the Parker Hill section of Roxbury, just south of the North Metropolitan System's Ward Street Headworks. The HSL's length is about 15 miles and extends through Hyde Park, Milton and Quincy to the Nut Island Plant. Along the sewer route, major flows are received from MWRA extension sewers including the Brighton Branch, Neponset Valley Sewer, Upper Neponset Valley Sewer, New Neponset Valley Sewer, Wellesley Extension Sewer, and the Wellesley Extension Relief Sewer.

Influent flows are also received from the Merrymount, Squantum, Braintree-Weymouth, and Houghs Neck pumping stations. The cross sectional size of the sewer ranges from 8 ft-3 inches by 9 ft-6 inches in the upstream reaches, to 11 ft-3 inches by 12 ft-6 inches at the entrance to the treatment plant. The average slope is approximately 1 ft per 3,370 feet, with the invert of the sewer dropping a total of 24 feet from Parker Hill to the plant. The HLS was generally constructed of either brick or concrete in the excavated sections, and was tunneled in some sections, depending on the depth and soil conditions. Recent modeling of the HLS by Metcalf & Eddy shows a peak hydraulic capacity without surcharging of 325 mgd at the existing hydraulic grade line. Potential changes in the elevation of the new Nut Island Headworks could increase the HLS capacity to about 360 mgd.

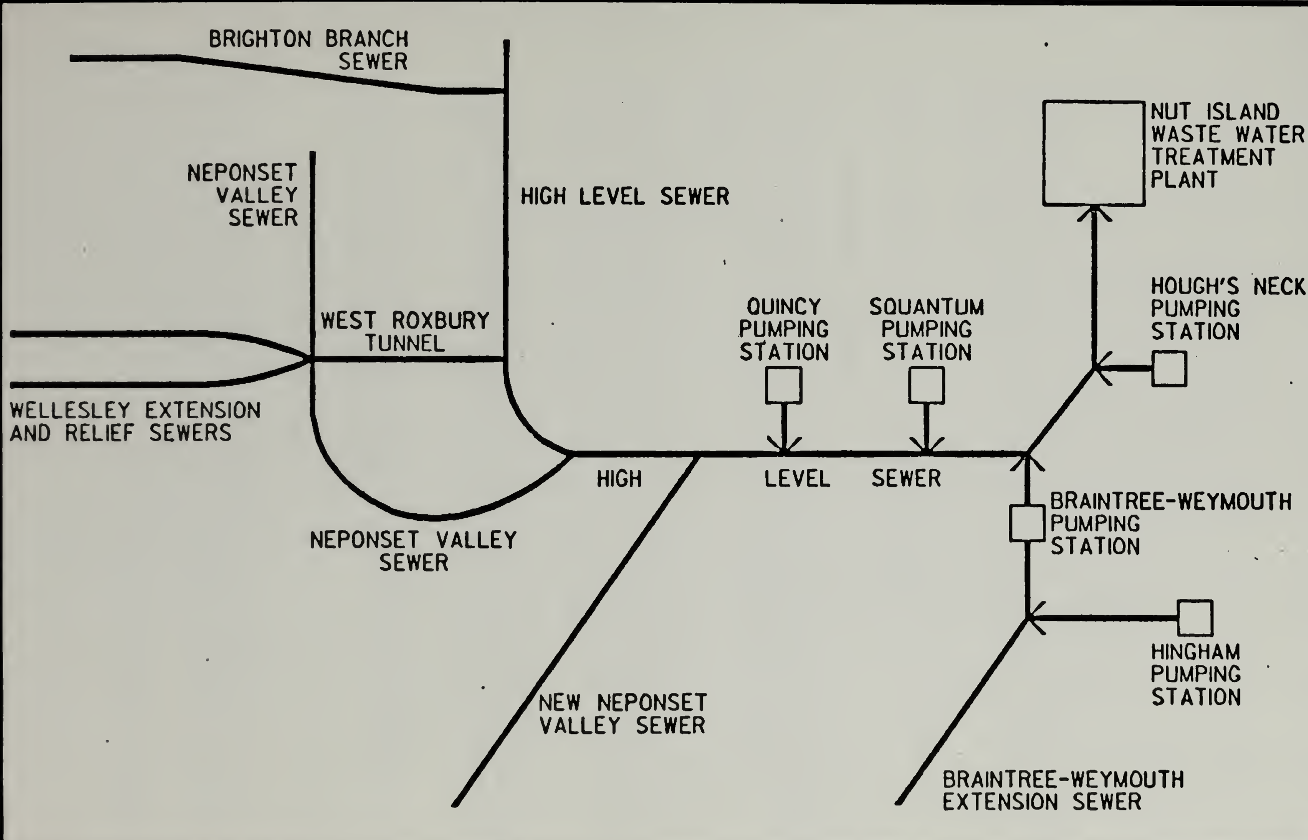
Main components of the South Metropolitan Systems are shown in Figure 5.1.2-1.

5.1.3 CHELSEA CREEK HEADWORKS

The Chelsea Creek Headworks was placed in operation in 1968 to provide preliminary treatment, consisting of screening and grit removal, to a portion of the flow being treated at the Deer Island Wastewater Treatment Plant.

Wastewater flows through this facility by gravity and is discharged to the North Metropolitan Relief tunnel through the 10-foot-diameter vertical shaft No. 2 which extends approximately 300 feet below grade. The 10-foot-diameter North Metropolitan Relief Tunnel, 20,800 feet long, conveys the wastewater under Boston Harbor to Shaft No. 1 and the main pumping station intake at the Deer Island Treatment Plant.

The headworks substructure is constructed of a brick, block, and metal siding. The concrete substructure which extends approximately 40 ft below grade contains four parallel treatment channels. Each channel at this headworks, as well as at the other existing remote headworks, is provided with the following equipment:



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.1.2-1
SOUTH COLLECTION SYSTEM SCHEMATIC

- o Inlet and outlet sluice gates
- o Mechanically cleaned fine screen
- o Mechanically cleaned grit settling basins
- o Parshall flume for velocity control and for flow measurement.

Each treatment channel is rated at 117 mgd peak capacity. The headworks capacity of 350 mgd allows for one treatment channel to be held in reserve. Pneumatic ejectors transport the screening and grit to above ground storage hoppers. Periodically, this material is discharged to trucks for disposal.

Fast-track improvements will include new climber-type mechanically cleaned screens, grit collection, screening and grit handling, and transport equipment.

5.1.4 WARD STREET HEADWORKS

The Ward Street Headworks is similar in most respects to the Chelsea Creek and Columbus Park facilities. This remote headworks, located in Roxbury Crossing, has been in operation since 1968 providing preliminary treatment consisting of screening and grit removal to the wastewater.

Flow through the Ward Street facility is by gravity. Effluent is discharged to the 15 ft-10 in diameter vertical Shaft A, which extends some 370 ft below grade to the Boston Main Drainage Tunnel. The Main Drainage Tunnel begins at the base of Shaft A, runs approximately 13,700 ft to Shaft B serving the Columbus Park headworks, and then proceeds 23,800 ft under Boston Harbor to Shaft C at the Deer Island Treatment Plant main pumping station.

The Ward Street Headworks consists of a brick and block multi-level superstructure and a reinforced concrete substructure which extends approximately 40 ft below grade. Within the substructure are four 85.3 mgd capacity channels, any three of which provide the rated capacity of 256 mgd.

Pneumatic ejectors transport the screenings and grit to aboveground storage hoppers. Periodically, this material is discharged to trucks for disposal. Fast-track improvements will be the same as those described for Chelsea Creek.

5.1.5 COLUMBUS PARK HEADWORKS

Except for size and processing capacity, the Columbus Park Headworks is similar in most respects to the other remote headworks. This facility, located in South Boston, went into operation in 1968 to provide preliminary treatment, consisting of screening and grit removal, to the wastewater prior to discharge to the Main Drainage Tunnel.

Flow through the headworks is by gravity. Effluent is discharged to vertical Shaft B which

extends approximately 300 ft below ground to the Boston Main Drainage Tunnel. The upstream segment of the tunnel is 10 ft in diameter and the downstream segment in 11 ft - 6 in. in diameter.

The headworks is constructed of a brick, block, and precast concrete multi-level superstructure and a reinforced concrete substructure extending approximately 30 feet below grade. Within the substructure are four treatment channels. Each channel is rated at 61 mgd and the headwork is rated at 182 mgd.

Pneumatic ejectors transport the screening and grit to aboveground storage hoppers. Periodically, this material is discharged to trucks for disposal.

Fast-Track improvements are the same as those described for other headworks.

5.1.6 WINTHROP TERMINAL

The Winthrop Terminal facility, located at the Deer Island Treatment Plant, is located between the existing administrative building and the primary clarifiers. The facility houses pumping equipment for flows arriving at Deer Island via the North Metropolitan Trunk Sewer and headworks facilities which provide preliminary treatment consisting of screening and grit removal. The North Metropolitan Trunk Sewer has a peak capacity of 125 mgd. The Winthrop Terminal was designed to screen and pump this entire flow and to provide grit removal for up to 60 mgd. Flows receiving grit removal are mixed with discharge from the Deer Island Main Pump Station for Treatment at the Deer Island Treatment Plant. Flows in excess of the capacity of the grit system are pumped directly to the Deer Island bypass for discharge to the plant outfall system.

Blowers, which provide air to the influent channels of the Deer Island primary sedimentation tanks, are housed within the Winthrop Terminal building.

Influent flow to the facility is split to three screening channels. Normally, one channel is in service at a time. During wet weather, high-flow events, all three channels are put into operation.

Screened wastewater flows by gravity to two wet wells. The wells are interconnected with a remote controlled sluice gate. The middle screening channel has the capability of discharging to either wet well. The gate interconnecting the wet well is in a constant open position, resulting in one common wet well for operational purposes.

From the wet wells, a bank of six centrifugal pumps lift wastewater to the effluent channel. Four of the pumps are electric motor-driven and rated at 15 mgd each. The two remaining pumps are diesel engine-driven and are rated at 30 to 60 mgd each, depending upon whether they are discharging to the effluent channel or the Deer Island Plant bypass line. From the effluent channel, flow passes through a Parshall flume to two aerated grit chambers. The maximum flow capacity of the grit chambers is 30 mgd each. Effluent from the aerated grit tanks discharges to a 54-in pipe. This flow is then mixed with the discharge from the Deer Island Main Pumping

Station and flows to the primary sedimentation tanks.

MWRA's recommended fast-track improvements will include replacement of existing coarse and medium bar screens with a 7/8-in-spaced climber-type bar screen, overhaul of electric pump motors, refit of pump impellers, construction of a grit bypass system, new instrumentation and controls, HVAC and odor control. The existing bypass will be replaced by the construction of a 4-ft by 4-ft weir flow controlled conduit, between the pump station discharge flume and the Deer Island Main Pumping Station effluent conduit which is connected to the preliminary treatment facility.

The bar screens were sized for two screens to handle the 125 mgd flow, with the third screen to be either held in reserve or out of service. After the fast-track improvements the Winthrop Terminal Pump Station will have the following capacity:

No. Pumps	Pump Impeller Diameter (inches)	Pump Rated Capacity mgd
2	42	37
4	24	22

In order to handle the 125 mgd design flow, at least five of the six pumps will have to be in operation, with only one pump on standby.

5.1.7 DEER ISLAND TREATMENT PLANT

The Deer Island Wastewater Treatment Plant, originally completed in 1968, provides primary treatment to flows from the North Metropolitan Sewerage System. The plant was designed to treat an average flow of 343 mgd and a peak flow of 848 mgd. Treatment consists of preaeration, primary sedimentation, and disinfection.

Flows from the Boston Main Drainage and North Metropolitan Relief Tunnels are pumped to the treatment plant at the Deer Island Main Pumping Station. Flows from the North Metropolitan Trunk Sewer are discharged to the plant via the Winthrop Terminal. Mixed flows are discharged to two preaeration channels. Primary treatment is provided by eight sedimentation tanks. Effluent from the primary tanks is chlorinated and discharged to the harbor through a series of outfalls.

Primary sludge, grease, and scum is collected, thickened, and pumped to anaerobic digesters. Digested sludge, and bypass flows from the Winthrop Terminal, are mixed with the primary effluent prior to discharge to the harbor.

Major Components

The major components of the original Deer Island Wastewater Treatment Plant include the following:

- Nine main sewage pumps. 90 mgd each
- Two preaeration channels, 400 ft x 20 ft
- Eight primary sedimentation tanks. 245 ft x 100 ft
- Four raw sludge pumping stations with three pumps in each
- Four anaerobic digester tanks
- Five diesel generating sets. 700kw each
- Seven chlorinators. 8.000 lb/day each
- Five outfalls to the harbor

Schematics of the Deer Island Wastewater Treatment plant showing the flow pattern. the number and arrangement of treatment units. and the outfall system are shown in Figure 5.1.7-1.

Main Pumping Station

The Deer Island Treatment Plant Main Pumping Station consists of nine vertical shaft. mixed flow. bottom suction sewage pumps. Each pump is rated for 90 mgd at 105 ft tdh and 400 rpm. The pumps were designed to be operated over a speed range of 250 to 400 rpm. An empty bay is provided in the pumphouse for a tenth pump.

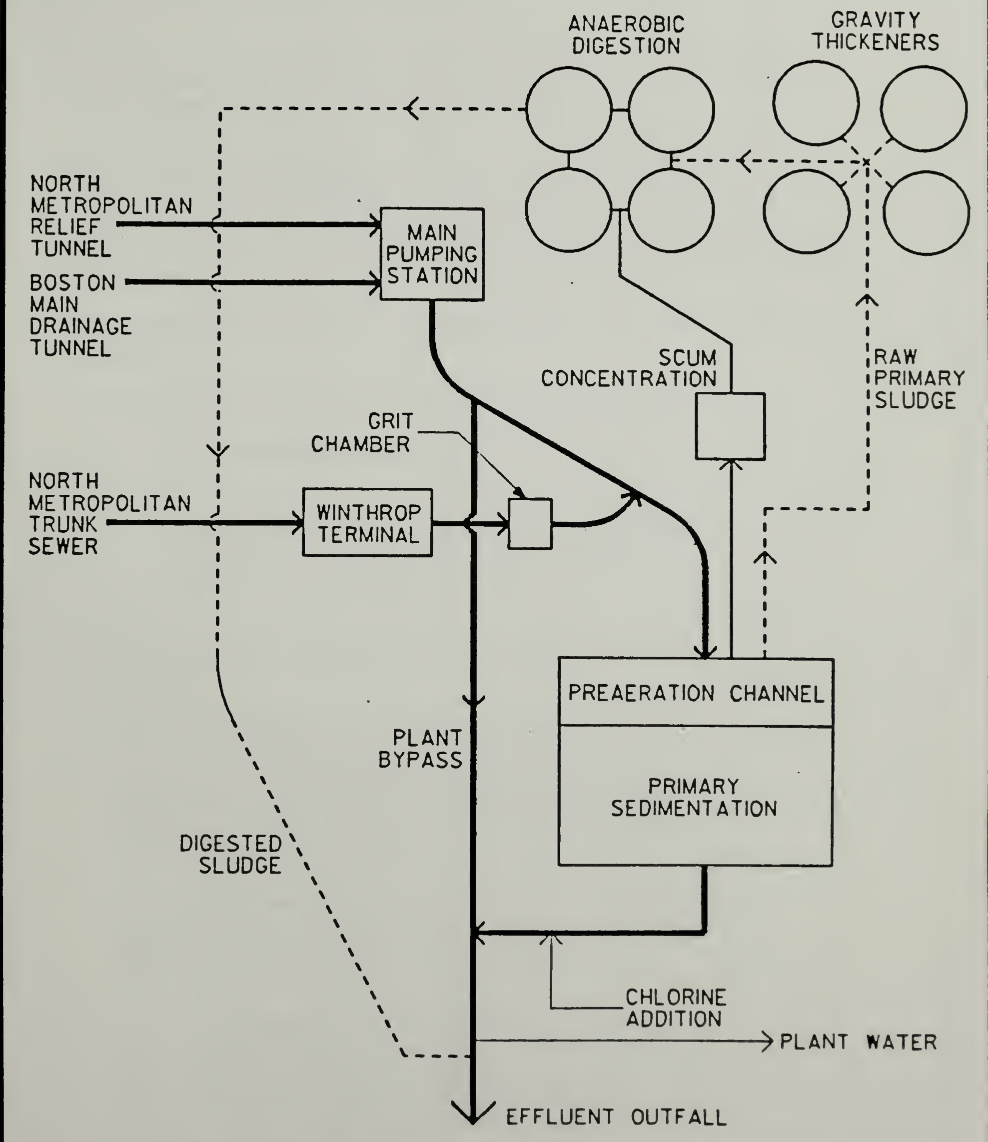
The pumps are driven through 90 ft long shafts. Eight pumps are driven by diesel engines. and one pump is driven by a 2.000 hp synchronous electric motor with a variable speed magnetic coupling.

The diesels are 12 cylinder. radial type. vertical shaft engines furnished by the Nordberg manufacturing Company of Milwaukee. WI and St. Louis. MO.

Each pump suction piping connects to a bifurcation which is piped to both the Boston Main Drainage and North Metropolitan Relief Tunnels. Each leg of the bifurcation contains a 60 in diameter butterfly valve and a 60 in diameter rubber expansion joint. The butterfly valves are pneumatically operated with a manual handwheel override. There are no valves on the pump discharge.

The pumps lift the wastewater to the treatment plant by a 60 in diameter pipe. Each pump discharge has a venturi meter to measure pump flow. Each pump discharge line is arranged as a siphon and each siphon is equipped with vacuum priming and vacuum breaking piping and valves. Two vacuum pumps are provided to prime the nine siphons.

The Deer Island Main Pumping Station receives wastewater from the three remote headworks and lifts it to the head end of the treatment plant. The pumping rate is adjusted to maintain a constant water level at the headworks. Pump start-up and shutdown. and butterfly valve opening and closing. are done locally. Adjustment of pump speed is done either manually or automatically in the control room. Pump suction valving is such that any pump may take suction from either tunnel. The original cast iron impellers have been replaced. Seven impellers are now stainless steel and two are nickel-iron alloy.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.1.7-1 DEER ISLAND WASTEWATER TREATMENT PLANT SCHEMATIC

The pump drivers are arranged in two rows (odd numbers to the west, even numbers to the east) at floor elevation 130 ft. the operating floor of the Main Pumping Station. The original plant design includes space allocation for a future pump (No. 10).

Based on discussions with plant operators and a review of the Deer Island Facilities Plan - Volume 1, Fast Track Improvement document, the unreliability and high maintenance associated with the Nordberg diesels constitute the most serious problem in the operation of the pump station/powerhouse facilities. These particular engines have been out of production since 1965, and Nordberg Mfg. Co. is no longer in business. Because of this, the cost of replacement parts is extremely expensive and some parts are virtually unobtainable.

The proposed fast track improvements to the Deer Island Main Pumping Station include the following:

- o Empty bay (No. 10) and pump bays (No. 2, 4, 6, and 8) will be equipped with:

  - Five new vertical centrifugal pumps, each rated 90 mgd at 105 ft tdh.

  - Four new 2,000 hp synchronous motors, variable speed magnetic coupling drives, and reduced voltage starters. One existing 2,000 hp electric motor and variable speed drive (No. 8) will remain in service.

  - One new 8 in. diameter solid steel shaft, bearings and couplings (No. 10).

- o Four existing shafts (No. 2, 4, 6, and 8) will remain in service and be modified to accept new 2,000 hp motors. Condition of existing shafts will be verified by non-destructive testing. Existing bearings will be evaluated and replaced as required. Method of lubricating bearings will be improved. New spacer couplings will be provided to facilitate pump maintenance.

- o Existing and new electric driven pumps will be controlled from a new pump control room to be located on the mezzanine level. New 4,160 V motor starters and variable speed drive controllers will be installed in a new electrical room also located at the mezzanine level.

- o Five existing Nordberg engines, shafts and pumps (no. 1, 3, 5, 7, and 9) will remain in service. These pumps will continue to be controlled pneumatically from a local panel at each engine. Remote auto-manual, speed, status and alarm conditions will be relocated to a new pump control room by installing P/I converters at the existing graphic panel and transmitting electronic signals to the new control room. The existing control room will be abandoned.

- o The existing pneumatic analog pump controller will be replaced with a new electronic analog controller (microprocessor) to accommodate the new electric motor-driven pumps and the new electronic signals from the existing Nordberg engine driven pumps.

- o The pump suction piping for the five electric motor driven pumps (No. 2, 4, 6, 8, and 10) will be revised to include a new 60-in knife gate valve downstream from each butterfly valve (one valve on each leg of the wye). They will be installed without dewatering the tunnel system and will protect the pump station against butterfly valve failure in the open position.

- o A new 60-in butterfly valve will be installed in the existing discharge piping of pump No. 2, 4, 6, and 8.

- o New 60-in steel discharge piping, flow meter and butterfly valve will be installed for the new pump No. 10 (empty bay).

- o The new discharge valves will allow the pumps to be started against a closed discharge valve instead of a closed suction valve, eliminating the cavitation condition that occurs at present. The new discharge valve will be closed just prior to normal shutdown of the pump.

Power And Utilities

The power station generating equipment currently consists of five diesel generator sets provided by the Enterprise Engine & Machinery Company of Oakland, CA. The diesels are eight cylinder, in-line type engines that can be operated on digester gas or diesel fuel. The generators are rated at 700 kw each and were furnished by Allis Chalmers.

The five diesel generators are arranged side by side and numbered sequentially from north to south, at the operating floor level (elevation 130 ft).

At the time of the site visit, four of the diesels were running and one was available on standby. The Enterprise engines are reliable and have good availability.

- o The five existing 700 kw diesels will be rehabilitated (under Diesel Engine Generator Overhaul Contract) and will remain in service.

- o Two new 6,000 kw dual fuel diesel engine/generator sets will be installed in a new building addition. New diesel engines will be started/stopped locally at each diesel and controlled from a new control panel in the switchgear room. Alarm and status indicators will be located at diesels, in switch-gear room, and in the new Pump Control Room.

- A new power distribution arrangement will allow the diesels to operate in parallel or be separated (5 existing diesels on one bus and 2 new diesels on another bus). In general, the two new diesels will power the electric-driven raw sewage pumps and the existing diesels will power all plant loads.

- The existing once-through cooling water will be replaced with a closed loop portable water system with heat rejection through cooling towers. The new system will recover heat from the jacket water of the Enterprise engines, the new 6,000 kw engines and the remaining Nordberg engines. The heated closed loop water will be routed through heat exchangers to provide heat to the sludge heating water, which in turn will be routed through heat exchangers to heat sludge at the digesters.

  The existing gas booster system is being rehabilited.

Treatment Facilities

Flows from the Main Pump Station and the Winthrop Terminal are discharged to two preaeration channels which also serve as distribution channels to the eight primary sedimentation tanks.

Sewage is conveyed from the Main Pump Station and Winthrop Terminal to the primaries via a 20-ft-wide by 14-ft-deep concrete channel which flows full. This channel splits into two 10-ft-wide by 14-ft-deep aerated channels, each of which feeds one-half of the primary tanks. Either of these channels can be isolated from the main influent channel by means of large motor operated sludge gates.

The two aerated channels are furnished with one stationary air diffuser and 22 swing arm diffusers each. Positive displacement compressors for these diffusers are located in the Winthrop Terminal Headworks.

From the aerated channels, wastewater is fed into each settling tank through ten manually operated or portable motor operated 24-in by 42-in sluice gates (downward operating). There are eight primary settling tanks at Deer Island. Each tank is approximately 100 ft wide by 240 ft long with an average side water depth of 11.35 ft. The tanks are equipped with traveling bridge collectors and chain and flight crosscollectors. Each tank has approximately 100 ft of straight-edge weir at its effluent end from which settled sewage falls into the effluent channel.

Traveling bridge collectors push scum to the effluent end of the tanks where the bridge pauses for a period of time while a reciprocating scum collector travels back and forth across the width of the tank and pushes scum over a V-notch weir on either side of the tank. Scum from all eight tanks flows to a central sump located between Tanks No. 4 and 5, from which it is pumped to scum thickeners. Sludge is pushed from the influent end of the primary tanks to the cross-collector hopper where it is moved to one end by a chain and flight collector. Sludge is withdrawn from the hopper by 12 sludge pumps, three for each pair of primary tanks.

The primary treatment facilities remove settleable and floatable solids within the constraints of their design capacities. Removal is dependent upon the flow rates to the facility and the number of primary tanks available for service.

The westernmost aerated influent channel of the settling tanks has substantial accumulations of grit, nearly reaching the water surface at the downstream end at the time of recent inspection. This may be caused by the poor condition of the swing diffusers, which have never been replaced, higher concentrations of grit to the westernmost channels due to hydraulic anomalies, lack of sufficient mixing air, poor upstream grit removal, or all of the above.

The swing diffusers are in poor condition. Those in the easternmost channel were replaced several years ago and are operable but have serious corrosion problems, with holes completely through the pipe in some places. Those in the westernmost channel are original equipment, and are in very poor condition. These diffusers create little visible turbulence and are covered with grit. Plug valves for the diffusers are rusted and some are stuck in the open position.

The inlet sluice gates and inflet baffles to the primary tanks are in poor condition. The sluice gates are opened and closed manually or by portable electric operators. The portable operator sometimes causes the gates to be opened or closed too far, creating high stresses on the gate itself or on the anchoring system. Half of the 80 gates show evidence of these problems. Five gates cannot be fully closed, making dewatering difficult. Maintenance of the sluice gates is hampered by their location on the aeration channel side of the wall (seating head). This means that for adjustments to be made on any one gate, one-half of the plant's primary treatment capacity must be removed from service. Each sluice gate has a steel inlet baffle just downstream on it, inside the tank. These baffles are severely corroded and some are completely missing.

Dewatered basins have reportedly experienced leakage through several expansion joints from full basins into emptied basins. It is not known at this time how many of the basins are affected or to what degree of severity the leakage occurs.

The water level in the effluent channel from the primary tanks was originally maintained by a tainter gate in order to provide chlorine contact time. A few years after start of operation, this gate became inoperable. As a result of this, the water level in the channel is now below the elevation of the scum sump float valve, and it too is inoperable.

Currently, one scum pump is continuously operating with the scum collection V-notches set to match this flow as closely as possible. However, the pump normally pumps slightly more than this, and lowers the water level in the sump until the pump begins taking air.

The scum collection system has proven to be a problem, particularly in winter months. Scum begins freezing at the V-notch weirs and if it is not broken up and manually pushed over the weir, the buildup begins extending out into the tank. This situation is difficult to overcome because the scum collecting mechanism must be started manually and thus does not clean the surface every time the traveling bridge delivers a load of scum. Further, the remote and exposed location of the scum collectors does not encourage manual attention, particularly

during severe weather when attention is most required. In the past, this problem has often proven disastrous, bending scum collectors on the traveling bridges and sometimes becoming so severe that tanks have had to be removed from service.

The following problems, related to the operation of the sludge pumping station, have been reported:

1. All of the Homestead crossover valves on the primary sludge pump intakes are frozen in either open or shut positions. Consequently, the middle pump at each station is available as standby for only one of the two tanks.

2. All of the sump pumps at the primary sludge pumping stations have either been removed or are inoperable. None of the pumps has worked for about 10 years. As a result, the crossover valves are usually submerged.

3. There are no check valves on the primary sludge pump discharge pipe.

4. The water seal glands and piping are corroded and in poor condition for all 12 primary sludge pumps.

5. For most of the primary sludge pumps, the coupling guard protection is gone.

6. Most of the primary sludge pump pressure gauges are rusted out, and none work.

The electrical power system and controls for many of the traveling bridge collectors are in poor condition. Much of the electrical conduit is badly rusted and most of the timers for short-and medium-pass bridge travel modes are inoperable or removed. Some chain and sprocket guards for the traveling bridges are badly rusted.

Turnbuckles and cables used for raising and lowering the sludge and scum collector blades are a constant problem because of corrosion and breaking. Cable and turnbuckles often break. When this occurs, the sludge scraper falls to the bottom of the tank and often becomes bent.

Originally, the traveling bridges were supplied power by bus bar. This caused severe problems during cold or wet weather, and the system was replaced with festooned cable. The cable has proven fairly reliable, except that occasionally a cable ring breaks and drops the cable to the rail where it is cut by the bridge wheel, putting the unit out of service.

The proposed fast-track improvements program at the Deer Island Primary Treatment Facilities includes the following components:

- Replacement of all 80 influent sluice gates and baffles to the primary tanks

- Replacement of the sludge collectors, traveling bridge drives, and hoists

- Rehabilitation of the traveling bridges

o Installation of new scum collection and pumping systems

Disinfection is provided to the plant effluent using gaseous chlorine. Chlorine can be used for disinfection of plant effluent. for pre-chlorination just prior to the primary tank preaeration channels. for pre-chlorination of influent flows to the Winthrop Terminal Headworks. and for disinfection of non-potable plant water.

Chlorine is delivered to the Deer Island Plant in two 16-ton tanker trucks. which are stored in the chlorine storage room. Each chlorine tanker truck is located on a separate weigh scale. Chlorine is withdrawn from the tankers and piped to a separate chlorine feed room which houses seven evaporators and seven chlorinators. Injectors are operated by non-potable plant process water and booster pumps. The injectors pull chlorine from the chlorinators under vacuum. and inject it at the various application points.

The existing chlorination system is at the end of its useful life. The following problems were observed:

1. The liquid chlorine supply lines are severely corroded. Availability of wrenches and safety equipment needed to make the supply line connection with the tanker truck dome valving should be improved.

2. Some of the overhead doors to the garage have deteriorated to the point where they either do not open or do not close. Some windows are inoperable.

3. The chlorine supply island should be provided with an additional escape route to be used when a chlorine leak has occurred.

4. The HVAC for the garage does not work.

5. Parts for original chlorinators are difficult or impossible to obtain.

6. The automatic controls for the chlorination equipment do not always function properly.

7. The chlorine gas detection system is antiquated and does not tell the operator where the leak has occured. This detection system does not detect leaks in every room in which chlorine is handled.

8. Chlorine solution piping and valving is in extremely poor condition. Some injectors have developed leaks.

9. The solution piping to pre-chlorination is currently disconnected. reportedly because it developed a leak in a buried section.

10. Injectors sometimes produce inadequate vacuum to operate the chlorinators.

11. There was a major leak in the chlorine solution feed piping during the last few years. The

chlorine solution backfed into the Winthrop gravity sewers and caused major concerns for the residents of the community. The chlorine diffusion system in the primary sedimentation effluent channels was recently replaced and is in good condition.

The Deer Island Fast Track Improvement program includes replacement and upgrading of the chlorination system.

5.1.8 NUT ISLAND TREATMENT PLANT

The Nut Island Wastewater Treatment Plant, originally completed in 1952, serves the South Metropolitan Sewerage System. Collection of sewage from communities served by the system is routed through the High Level Sewer to the treatment plant. Treatment provided at the plant consists of screening, grit removal, preaeration, primary sedimentation, and disinfection. Plant effluent is discharged to the harbor. A schematic of the plant is presented in Figure 5.1.8-1.

Flow enters the facility at the headworks, where it is channeled to two catenary-type bar screens that are operated by timers. Large solids and trash are caught on the screens, raked to an ejector pot and ejected by air to a receiving container.

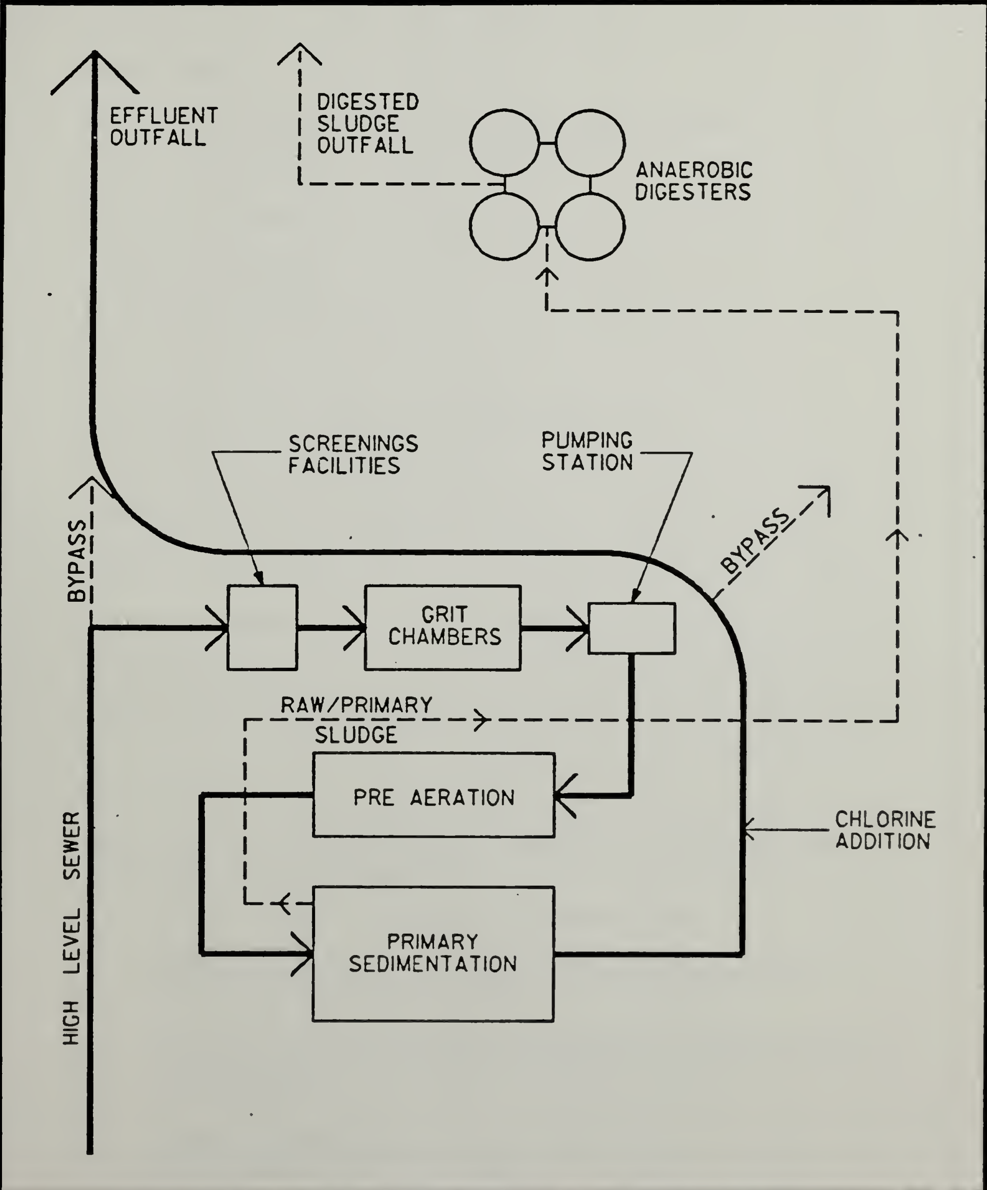
From the screenings area, wastewater is diverted to six grit chambers. Grit is collected by a chain and bucket mechanism, scraping the floor of the chamber and depositing the grit on a conveyor for transport to the ejector pots. Once a sufficient quantity of grit is collected in the pot, air is used to eject the material to a receiving container. The screenings and grit removed from the wastewater flows are deposited into a common container. A private contractor hauls the material off-site on a regular basis.

The screened, degritted wastewater flows to the main wet well from which it is pumped to the preaeration and primary sedimentation basins.

Pumping of the plant flow is provided by four main sewage pumps rated at 83 mgd each. Pumped sewage is metered through a venturi meter and discharges to five preaeration basins. At the preaeration basins, air is injected into the waste stream by two 5000 cfm blowers. Primary sedimentation is provided by six sedimentation basins. Sludge and grease are anaerobically digested in four digesters and routinely withdrawn, disinfected and discharged through the sludge outfall to the Harbor off Long Island.

Chlorine is applied to sedimentation basin overflow for disinfection prior to its discharge to the harbor through one of three outfalls.

The High Level Sewer has a maximum capacity of 325 mgd. A portion of these peak flows are bypassed prior to treatment dependent upon the number of treatment units available at the plant at any one time. At the entrance of the High Level Sewer to the plant, there is an emergency spillway at Elevation 120.30. Overflows to this spillway occur when flow to the plant reaches about 280 mgd with both bar screens available.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 5.1.8-1 NUT ISLAND WASTEWATER TREATMENT PLANT SCHEMATIC

Major Components

The Nut Island Sewage Treatment Plant includes the following major components:

- Two bar screens, 7 ft x 17 ft 6 in, with 7/8 in bar openings
- Six parallel grit chambers, 83 ft x 10 ft 6 in
- Four main sewage pumps
- Five preaeration channels, 167 ft 3 in x 21 ft
- Six primary sedimentation basins, 185 ft x 64 ft x 13 ft deep
- Three grease and sludge pumping stations with three pumps in each
- Four digester tanks, 2.3 million gallons each
- Two digested sludge pumps, 320 gpm each
- Three 719 KVA generators
- One 563 KVA generator
- Two 5000 cfm blowers
- Pre- and post-chlorination with storage for two 15-ton tankers

Recent Improvements

Since 1984, a number of improvements have been implemented at the Nut Island Wastewater Treatment Plant. These improvements include:

- Addition of influent flow meter (sonic type) to the High Level Sewer.
- Installation of new ventilation system, odor control equipment, and explosion-proof electrical components added to the grit room.
- Abandonment of comminutors immediately downstream of the grit chambers. The effluent channels from the grit tanks were rebuilt for smoother transition and for a decrease in headloss.
- Rebuilding of one engine generator and one preaeration blower motor. Spare parts were stored for all engines.

- o Installation of off-site, purchased power service.

- o Replacement of most of the air header to the preaeration tanks with new line.

- o Construction of improvements to the primary tanks including:

    Rebuilding tanks structurally, repairing leaks, columns, and supports for sludge collectors. Refilling tank floors. Replacing all weirs and replacing sludge collection equipment. Replacement of outside sludge piping from the primary sludge pumps to the anaerobic digesters with 250 lb. glass-lined ductile iron piping. Addition of a programmable controller for automated operation of the sluice gate on Outfall 103.

5.2 DEER ISLAND HOUSE OF CORRECTION

The Deer Island House of Correction is a complex of 20 structures occupying approximately 40 acres. The prison, which has an inmate population of approximately 400 and a total staff of 200 guards and employees, has deteriorated over the years and has been under a Court Order to upgrade its detention facilities. Studies by the City have shown that the most cost effective approach to upgrading would be to build a completely new prison rather than to rehabilitate the existing collection of old structures. (See Figures 5.2-1 and 5.2-2).

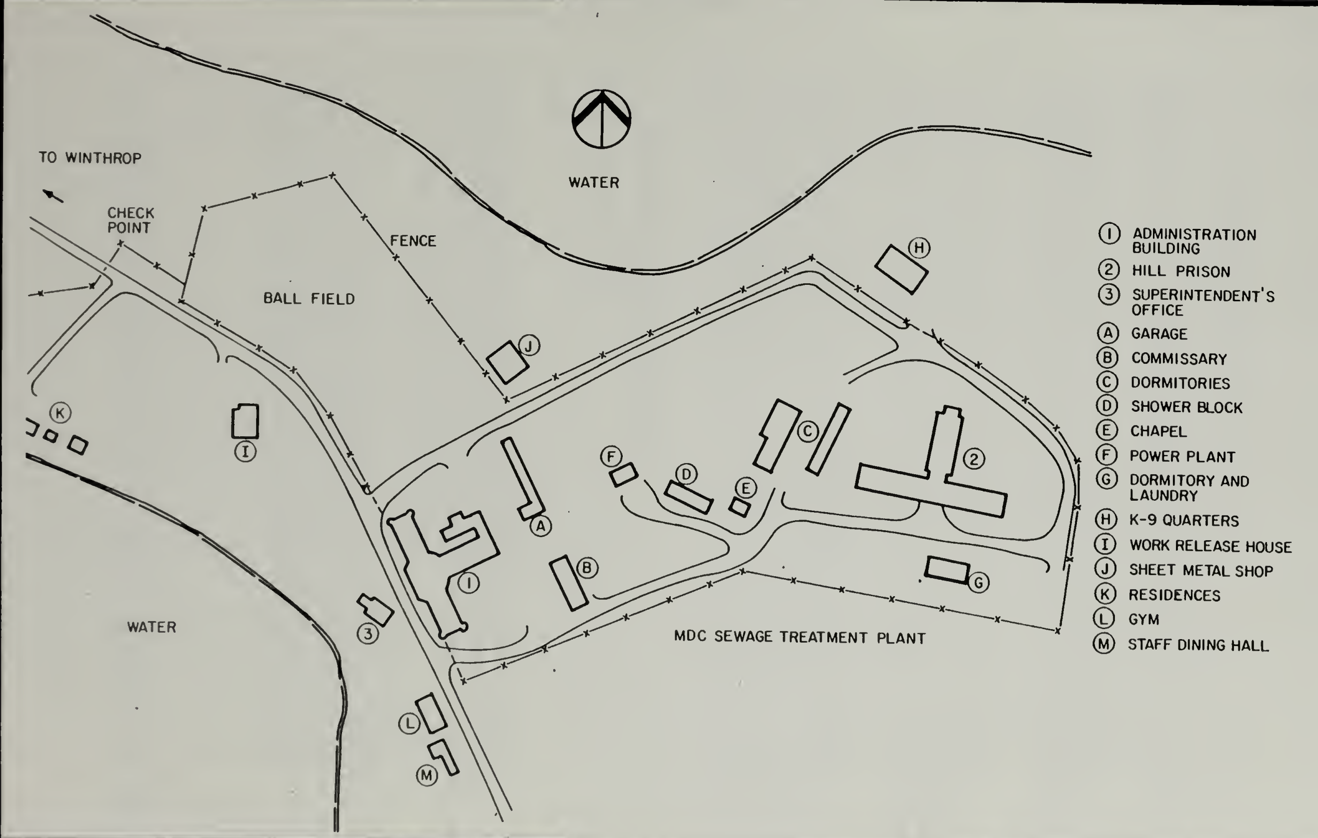
The prison Administration Building, constructed about 1850 with major renovations in 1929 and 1949, is used as administrative offices, reception and cells for new prisoners, training and schoolrooms, and workshops. The building appears structurally sound but worn and neglected.

The Hill Prison is the main prison building. It was built in 1902 and appears to be structurally sound although the inside has been poorly maintained, with surfaces showing signs of much wear, makeshift repairs and careless painting.

The Superintendent's Office is a two-storey brick building, situated opposite the Administration Building, which was once the Superintendent's residence. The house appears in sound structural condition though inadequately maintained.

Ancillary Buildings include the following:

a. Garage - 20th century
b. Commissary - 20th century. This building was previously three and a half stories, was reduced to a one-storey building in 1946.
c. Dormitories (former Dairy Barns) - 1957 and 1958. Architect, Joseph F. Page.
d. Shower Block - probably the former Poultry House, 1957. Architect, Joseph F. Page.
e. Chapel - 1950's.
f. Power Plant - 1958. Engineers, J. M. McKusker Associates.
g. Dormitory and Laundry (opposite Hill Prison) - this building may be a remnant of the nineteenth century pauper girls school.
h. K-9 Quarters - 1980's On site of former piggery.



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 5.2-2
DEER ISLAND
HOUSE OF CORRECTION LAYOUT

i. Work Release House - 1920's(?)
j. Sheet Metal Shop - 20th century.

The Deer Island House of Correction Site Plan consists of a grouping of major and ancillary buildings informally sited in an institutional yet rural setting.

The buildings form two clusters. Near the water's edge, the predominant building is the Administration Building, sited parallel to the main road that traverses the island. Opposite the Administration Building is the Superintendent's Office: nearby is the Work Release House. Behind the Administration Building and parallel to it are a Garage and Commissary.

Up on the hill the predominant structure is the Hill Prison, sited on a street sometimes referred to as Hill Prison Street. Across from the Hill Prison are the Dormitory and Laundry. Next to the Hill Prison are two Dormitories, a Chapel, and Shower Room, and the Power House. Below and across a road is the Sheet Metal Shop. Behind the Hill Prison are the K-9 Quarters.

The buildings are informally set on the site, which has a character that is institutional, industrial and rural. There is a loop road that gives vehicular access to all buildings. It is paved, but without curbs in most places. The largest expanse of paved area is between the Administration Building and the Garage and Commissary. Stone retaining walls and foundation walls of demolished buildings occur on the site. Cyclone fencing and wooden telephone poles are in evidence. Trees, bushes and an overgrowth of grass contribute to the rural character of the site.

5.3 OTHER FEATURES AND STRUCTURES

Deer Island Pumping Station

Historey

In 1889, legislation, prompted by reports of the Massachusetts State Board of Health on pollution of Boston Harbor, authorized the formation of the Boston Metropolitan Sewerage Commission. By 1900, the North Metropolitan Sewerage System, serving the 14 cities and towns of the Commission's northern region, was fully operational.

The North Metropolitan system's 74 miles of sewer lines connected nearly 1,000 miles of local lines and pumped to an outlet in the Boston Harbor at Deer Island. The Pumping Station at Deer Island was the largest of three stations constructed to pump sewage through the North Metropolitan system. Constructed in phases in the period from 1894 to 1900, the Deer Island Pumping Station's development reflected the growing needs of the region's burgeoning population.

Site Plan

The Pumping Station at Deer Island lies on the southwesterly side of the island about midway down its length. Actually a complex of five attached buildings, the development of the station

reflects the development of the North Metropolitan Sewerage System which it served. Completed in three phases between 1894 and 1899, the complex contains a Screen House, Coal House, Boiler Room and two Engine Rooms. The buildings give the appearance of a single structure, designed in a compatible manner by Arthur F. Gray, architect for the stations at Charlestown and East Boston. Though operated in the periods between construction, it became fully operational in May of 1900. The Station was in operation until 1968 when the Deer Island Sewage Treatment Plant was completed. The building, still containing the old machinery, is now abandoned. To the southeast of the pumping station complex is a 2 storey shingle structure of unknown origin or use but which will be referred to as the Farmhouse.

Facing the westerly elevation, the Pumping Station buildings are, from left to right:

Screen House (ca 1895)

A two-storey brick, granite and terra cotta structure 27 ft x 23 ft. Built in a simple vernacular industrial style with Queen Anne - Romanesque elaborations and detailing, it has a hipped roof of slate with terra cotta tile coping and is surmounted by a cupola, now only partially extant.

The building covers the screen shaft of the pumping station system and contains machinery for hoisting and pressing. Sewage was screened with double rows of wrought iron bar cage screens before it was put through the pumping machinery. The Screen House and the adjacent Coal Pocket were constructed after the Boiler Room and the first Engine Room.

Coal Pocket (ca 1895)

A one-storey brick, granite and terra cotta building, 74 ft x 34 ft with a dynamo room attached. Styled similarly to the Screen House, it also has a slate pitched roof punctuated by dormer-type openings and terra cotta tile coping.

The engines for the pumping station were powered by coal burned in the boiler room until the facility was converted to diesel fuel in the 1950's. The Coal Pocket was designed to hold 600 tons of coal.

Boiler Room and Chimney (Sept. 1894)

A one-storey brick, granite and terra cotta structure, 63 ft x 35 ft with a height of 17 ft to the roof trusses and an accompanying masonry chimney 125 ft in height. The building is styled in a vernacular Romanesque with Queen Anne details, with slated pitched roof with terra cotta tile coping and topped with a ventilation structure. Converted from coal to diesel in the 1950's, the boilers still remain intact. The boiler room and the first engine room were the initial structures built for the pumping station, which shares its pattern of boiler room-engine room with the stations at East Boston and Charlestown.

Engine Room (first) (Sept. 1894)

A one-storey brick. granite and terra cotta structure. 100 ft x 31 1/2 ft. with a height of 15 ft to the roof trusses. Styled in a vernacular Romanesque with Queen Anne detailing. it also has a pitched slate roof punctuated by dormer-type openings and with terra cotta tile coping. Similar to the stations at East Boston and Charlestown. it was originally equipped with two triple-expansion Corliss type steam engines.

Engine Room (second) (ca. 1899)

A two-storey brick structure approximately 50 ft by 50 ft with a hipped slate roof. Built in a more formal style with Romanesque details of round-headed arches. brick patterns to create circles. and horizontal lines denoting function.

Because of a need for increased system capacity. an extra pump and engine were added to the Deer Island Pumping Station and housed in this structure. The machinery is still extant.

Farmhouse (ca. 1900)

Approximately 300 feet to the southeast of the Pumping Station stands a two-storey wood and shingle Queen Anne and Colonial Revival structure believed to have been a farmhouse. No information about its construction or design has been found to date. Little is known about its structural integrity.

Section 6

6.0 EXISTING AND FUTURE CONDITIONS

6.1 EXISTING ENVIRONMENT

6.1.1 PHYSIOGRAPHY AND GEOLOGY

Physiography

The dominant topographic and geologic feature on Deer Island is the central drumlin, which crests at approximately elev.210. The major axis of the drumlin is oriented east-west and extends approximately 2,000 ft with a minor axis of about 1,000 ft. Another smaller, partially eroded drumlin is located at the north shore of the island and stands at a maximum elev.170. The small drumlin is believed to have been just as large as, and oriented roughly parallel to, the central drumlin; however, due to significant erosion along the seaward side, the major axis of this drumlin is currently oriented northwesterly and extends approximately 1,400 ft with a minor axis of about 400 ft. The remnant of a third drumlin is barely perceptible at the southernmost tip of the island. This feature shows little topographic expression and no longer presents a distinctive form.

The processes of weathering and erosion have significantly modified the structure of the island. It was during a severe hurricane in 1936 that the channelway known as Shirley Gut was closed off by wind and current action. At this time Deer Island became, in actuality, a peninsula of the mainland. Wave action has severely affected the northern and eastern shorelines to the point that a seawall was erected to suppress the degradation. Similarly, tidal currents have remolded and redeposited glacial sediments in the formation of a sand and gravel extension of the island southward toward President Roads.

Man-made features have necessarily altered the contours of the island over the years. Construction of the existing sewage treatment facility required removal of part of the central drumlin along the northwest flank. In addition, a water reservoir was constructed at the crest of this drumlin. A swamp/tidal marsh area north of the central drumlin was backfilled to facilitate construction of the existing treatment plant. Fill materials have also been placed along roadways, particularly along the western shore of Deer Island. Excavation spoil or "tunnel muck" from previous shaft excavations has also been placed along an area of the western shoreline near the existing treatment facility. Approximately 600 ft south of the central drumlin, near the eastern shore of the island, stands a man-made earthen bunker formerly used by the military as part of the coastal defense system. This structure is elongate in a north-south direction, extending about 700 ft with a minor axis of approximately 250 ft. The maximum relief is about 40 ft above the surrounding topography.

Geology

The Deer Island drumlins were deposited by the retreating glacier onto a very compact unit of clay, sand, gravel, and boulders, which in turn overlies an irregular bedrock surface. Flanking the slopes of the drumlins are marine deposits and stratified glacial drift. These consist chiefly of a marine clay overlain by sand and gravel outwash containing occasional

lenses of glacial till. The uppermost unit consists of more recent deposits of silty fine to medium sand with some traces of organic material. The bedrock is predominately argillite and is persistent throughout the area of the island.

Surficial Deposits. A dense to very dense mixture of clay, silt, sand, gravel and boulders (glacial till) covers the bedrock surface and comprises the drumlins on Deer Island. Till thicknesses approaching 200 ft have been noted in the area of the central drumlins. As is typical of glacial till deposits, the proportion of this coarse- to fine-grained material is highly variable. However, isolated pockets and lenses of near-homogenous fine materials occur throughout the tills. The remaining land area soils, adjacent to and between the drumlin exposures, consist of a gray silty clay and are generally overlain by sand and gravel outwash deposits. The clays vary in thickness, reaching maximum thicknesses of up to 50 ft, and becoming thicker near the shoreline, whereas the sands and gravels generally range from 0 to 20 ft in thickness.

Organic silts, peat and muck have been observed in borings in low lying areas between the drumlins. This occurrence would be indicative of the formation of a tidal marsh or backswamp during a period of lower sea level. A subsequent rise in sea level permitted deposition of the fine sand and gravel associated with the more recent beach deposits.

Bedrock Geology. As is much of the Boston Harbor area, Deer Island is underlain by slightly metamorphosed and often complexly folded and faulted argillite. This is generally very thinly bedded, occasionally laminated to non-bedded fine grained rock characterized as the Cambridge Formation of the Boston Basin Group. Bedding or laminations are quite prominent as alternating light and dark gray bands which generally dip 25° to 50° from the horizontal. Fractures (partings) in the rock are generally observed parallel to the laminations. The rock is well indurated and, with few exceptions, ranges from moderately-hard to hard. Unconfined compressive strengths varied from less than 4000 psi to greater than 35,000 psi, with average values of 15,000 - 20,000 psi. Based on borings and a seismic refraction survey, the topographic relief of the bedrock surface varied from approximately elev. +30 beneath the central drumlin to elev. -40 along the western side of the island.

Due to the complex sedimentary and structural history of the harbor area, other rock types are often found interlayered with, faulted into, or intruded into the argillite. Other rock types associated with the Boston Basin Group include tuffs, sandstone, quartzite and conglomerates in addition to intrusions by dikes and sills of diabase, basalt and/or andesite. At Deer Island the only known occurrence of rock other than argillite is that of a basalt sill found at tunnel level near the vertical shaft to the Main Drainage Tunnel. However, this does not preclude the existence of other bedrock types on the island.

6.1.2 SURFACE AND GROUNDWATER HYDROLOGY

Surface Water

As described in section 6.1.1, the natural contours of Deer Island have been significantly altered over the years. There are no natural surface water bodies on Deer Island. Man-made

surface water features consist of the existing primary treatment tanks and a three million gallon cooling water reservoir located at the top of the central drumlin. Rainfall runoff in the developed areas of the prison and the treatment plant is either collected by roads/catch basins and drained to the harbor, or is collected and discharged to the harbor via the treatment facility. Rainfall runoff in all other areas of Deer Island is discharged to the harbor via natural swales or drainage areas.

The wastewater treatment plant and Fort Dawes, located at the southern end of Deer Island, have created shoreline protection and alterations such as riprap, groins, seawalls, and piers. These shoreline alterations nearly encompass Deer Island.

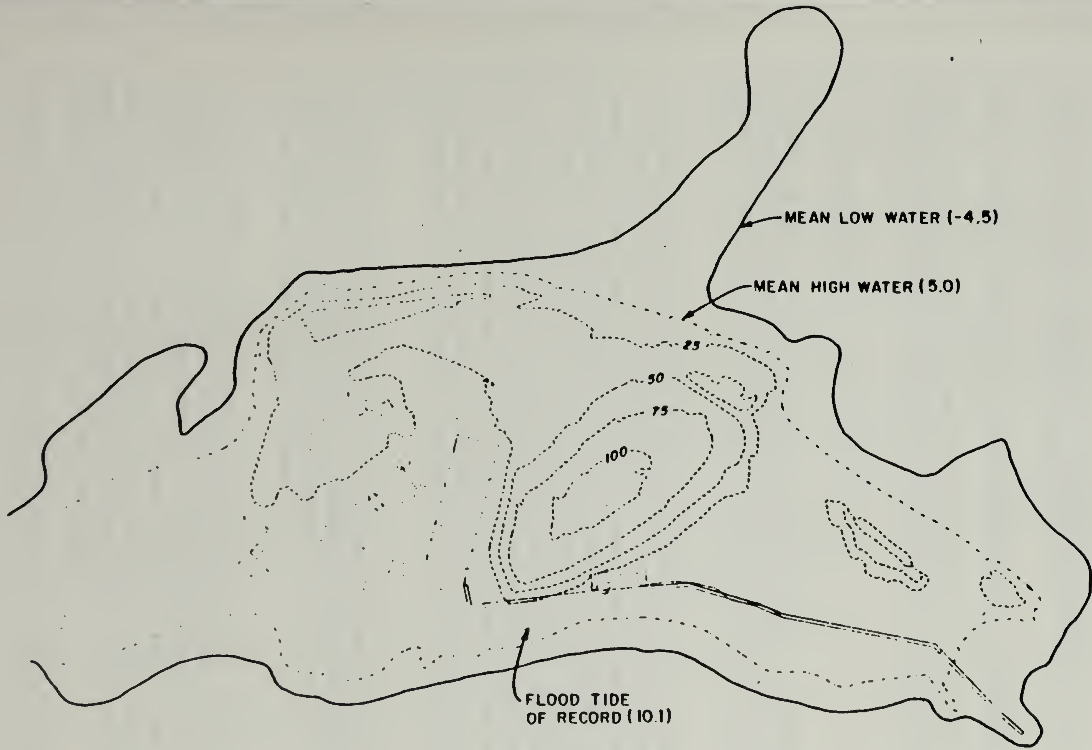
Figure 6.1.2-1 identifies the locations of flood tide of record, mean high water, and mean low water, relative to USGS datum. The 100-year flood elevation is obtained from the Federal Emergency Management Agency. All other elevations are obtained from a study prepared for the City of Boston (CDM, 1967). Comparison of these elevations with the MDC sewer datum (MDCSD) is as follows:

	Elevation, ft, MDCSD	Elevation, ft, USGS
Flood tide of record	115.7	10.1
100-year flood	115.6	10.0
Mean high water	110.6	5.0
Mean sea level	105.6	0.0
Mean low water	101.1	-4.5

Groundwater Hydrology

As indicated above, mean sea level at Deer Island is at 105.6 ft, MDCSD. In the low-lying areas adjacent to and between the drumlins of Deer Island, groundwater levels generally vary between elevation 108 to 114 ft (approximately 8 to 11 ft below ground surface). (Metcalf and Eddy, 1983; CDM, 1986).

At the central drumlin there appears to be a perched water table that generally follows the contour of the drumlin. Here the water table lies within a sandy, clayey, gravel (till) at depths varying between 10 to 30 ft below the ground surface. Near the crest of the drumlin the water table may be at an approximate elevation of 172 ft. Storage and recharge capacities are thought to be limited, due to the dense and impervious nature of the till.



NOTE:
ELEVATIONS ARE FT., USGS DATUM

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FIGURE 6.1.2-1
EXISTING DEER ISLAND TOPOGRAPHY

Section 6.1.2 References

Camp Dresser & McKee. September. 1967. Report on Improvements to the Boston Main Drainage System, Volume I. HUD Project No. P-Mass-33-6.

Metcalf & Eddy, Inc., April, 1983. Draft Geotechnical Report - Site Options Study.

Camp Dresser & McKee, October. 1986. Field Investigations and Interim Closure Design Plant and Report for Grit and Screenings Disposal Areas On Deer Island - Appendix A, Groundwater Well Boring Logs.

6.1.3 METEOROLOGY

The climate of the Deer Island area is best described using long-term representative meteorological data collected at the National Weather Service Office at Logan International Airport in Boston, Massachusetts. The airport is located approximately 1.2 miles west of Deer Island.

The climate of the region is continental; however, the Atlantic Ocean has a significant moderating effect. Sea breezes occur on hot spring and summer afternoons displacing the warm, westerly airflow with a cool, moist east wind off the water. These breezes generally develop several hours after sunrise and persist for most of the afternoon. The region is situated near 42° N latitude, in the prevailing westerlies, and the weather undergoes alternating intrusions of tropical and polar air masses. In the early fall, hurricanes can bring destructive winds to the area. From late October to late April, major east coast storms bring significant rain and snow. During the warmer season, May through September, rainfall is mostly limited to showers and thunderstorms which accompany frontal passages. Thunderstorms occur on an average of 19 days during the year. On the average, precipitation occurs 1 out of 3 days throughout the year.

New England is affected by high and low pressure systems which originate from areas of North America that differ significantly in climate. The direction of air flow and duration of a particular air flow direction over New England depends on the track (relative to New England) and speed of these high and low pressure systems.

Two types of high pressure systems or air masses frequently affect New England: polar continental and tropical maritime. The general tracks of these two types of systems are shown in Figure 6.1.3-1. A polar continental high pressure system originates in the polar region of the North American continent. This type of system affects New England during all seasons and usually brings dry, abnormally cold air with partly cloudy sky conditions. The tropical maritime high-pressure system originates from the tropical region of the Atlantic Ocean and usually imports abnormally warm humid air to New England.

Low pressure systems which affect New England generally move from the west or the south, as

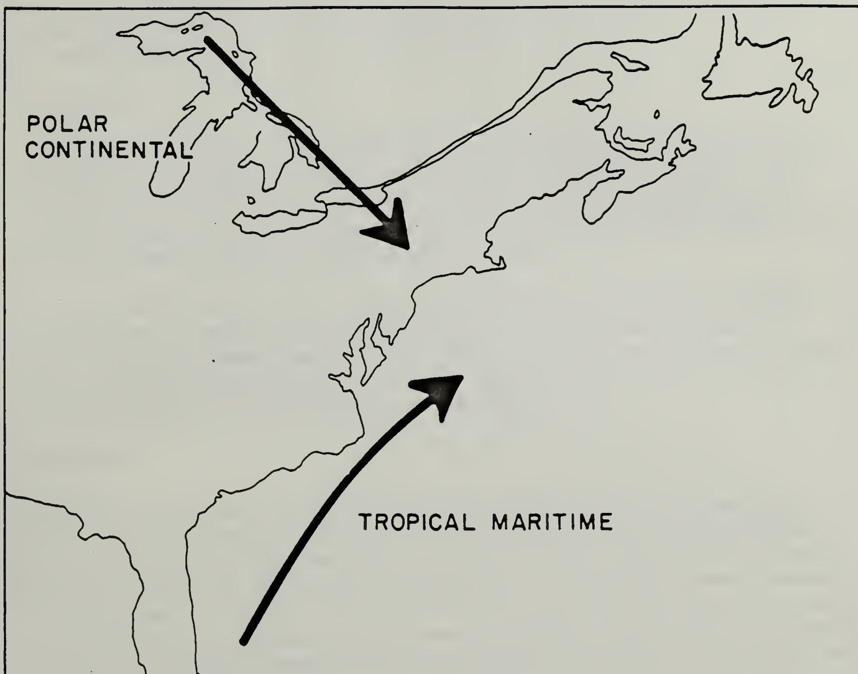

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FIGURE 6.1.3-1
GENERAL MOVEMENT OF AIR MASSES
WHICH FREQUENTLY AFFECT NEW ENGLAND
DEER ISLAND WASTEWATER TREATMENT PLANT
ENVIRONMENTAL IMPACT REPORT

shown in Figure 6.1.3-2. Winter low pressure systems are larger and more intense than summer systems and tend to track up the Atlantic seacoast. Flows off the ocean, affecting all of New England for extended periods of time, are usually the result of the counterclockwise flow around a low pressure system passing to the east of New England. Low pressure systems which originate in the center of the United States are usually drier and less intense than coastal low pressure systems.

Precipitation

The annual average precipitation in Boston for the period of 1943 through 1982 was 41.40 inches with amounts ranging from as low as 23.71 inches in 1965 to as high as 62.32 inches in 1954. A maximum 24-hour rainfall value of 8.40 inches occurred in August 1955. Table 6.1.3-1 lists minimum and maximum monthly precipitation statistics for Boston, Massachusetts. Table 6.1.3-2 presents the average monthly and seasonal precipitation values.

The first measurable snowfall of winter usually occurs about the end of November, and the last snowfall in spring is generally near the middle of March. The average annual snowfall is 42 inches, with amounts ranging from as low as 10.3 inches in 1972-1973 to as high as 89.2 inches in 1947-48. Average monthly snowfall values are also presented in Table 6.1.3-2. A monthly maximum snowfall of 41.3 inches occurred in February 1969.

Temperature

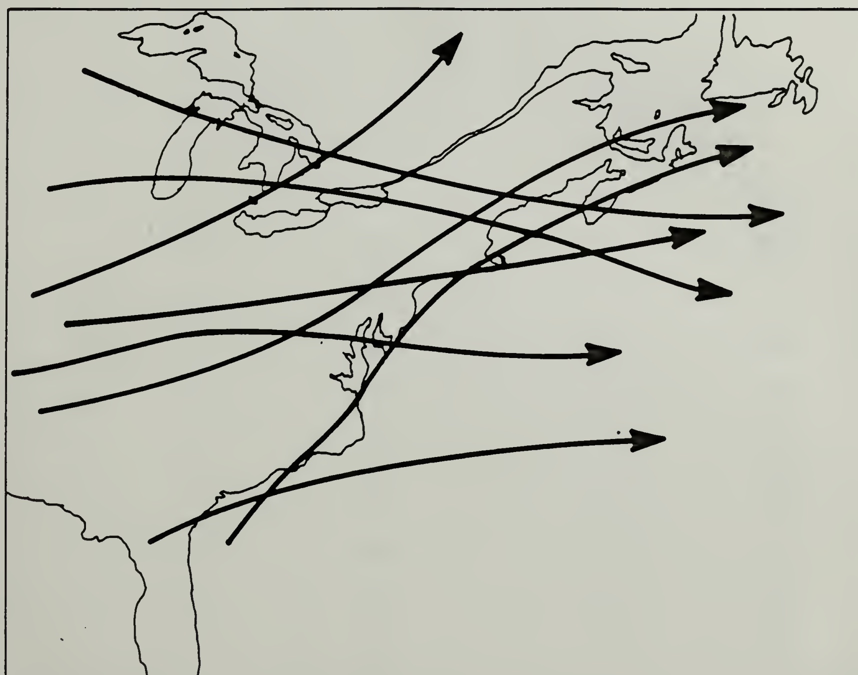
The mean annual temperature is about 50° F, but seasonal variations bring tropical warmth of 90° F or greater in the summer and polar cold of 0° F or less in winter. The coldest months are January and February, averaging about 29° F. The record minimum temperature of -12° F was recorded in January 1957. July and August average near 70° F with a record maximum temperature of 102° F recorded in July 1977. Freezing temperatures occur on an average of 99 days per year from mid-November through March, and very warm days of 90° F or higher average 12 occurrences annually. The average daily maximum and minimum temperature values by month and season are also presented in Table 6.1.3-2.

Fog

Heavy fog is not uncommon in Boston, but usually lasts less than a day. Contrasting temperature difference over the North Atlantic Ocean often create large fog banks which can move inland across southeastern New England any time of the year. The fog can lower visibility to 1/4 mile or less. Such dense fog occurs on the average of two times per month.

Relative Humidity

The annual average relative humidity in Boston is 67 percent. The average of the highest daily relative humidity values is 72 percent. These highest daily values are experienced at night and during early morning hours. The drier afternoon and evening hours average 58 percent and 65 percent at 1:00 p.m. and 7:00 p.m., respectively.



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.3-2 TYPICAL TRACKS OF LOW-PRESSURE SYSTEMS AFFECTING NEW ENGLAND DEER ISLAND WASTEWATER TREATMENT PLANT ENVIRONMENTAL IMPACT REPORT

TABLE 6.1.3-1

PRECIPITATION DATA FOR BOSTON
1952 1982

	Minimum Monthly Precipitation in Inches and Year of Occurrence		Maximum Monthly Precipitation in Inches and Year of Occurrence	
Jan	0.74	1980	10.55	1979
Feb	0.88	1980	7.08	1969
Mar	0.62	1981	11.00	1953
Apr	1.24	1966	7.82	1958
May	0.25	1944	13.38	1954
June	0.48	1953	13.20	1982
July	0.52	1952	8.12	1959
Aug	0.83	1972	17.09	1955
Sept	0.35	1957	8.31	1954
Oct	0.34	1946	8.68	1962
Nov	0.64	1976	8.18	1969
Dec	0.97	1980	9.74	1969

Minimum yearly precipitation: 23.71 inches (1965)
Maximum yearly precipitation: 62.32 inches (1954)
Average yearly precipitation: 41.40 inches

SOURCE:

Department of Commerce, 1982. National Oceanic and Atmospheric Administration: Local Climatological Data, Annual Summary with Comparative Data, 1982, for General Logan International Airport, Boston, Massachusetts.

TABLE 6.1.3-2

MONTHLY AND SEASONAL CLIMATIC SUMMARY OF BOSTON, MASSACHUSETTS

	Average Daily Maximum Temperature 1941-1970 (oF)	Average Daily Minimum Temperature 1941-1970 (oF)	Average Precipitation 1943-1982 (inches)	Average Snowfall 1943-1982 (inches)	Average Wind Speed 1958-1982 (mph)
December	39.3	26.6	3.65	8.0	13.6
January	35.9	22.5	3.67	12.6	14.2
February	37.5	23.3	3.38	11.6	14.0
Winter	37.6	24.1	10.70	32.2	13.9
March	44.6	31.5	3.79	7.7	13.8
April	56.3	40.8	3.55	0.9	13.5
May	67.1	50.1	3.23	Trace	12.1
Spring	56.0	40.8	10.57	8.6	13.1
June	76.6	59.3	3.17	0.0	11.4
July	81.4	65.1	3.13	0.0	10.8
August	79.3	63.3	3.57	0.0	10.7
Summer	79.1	62.6	9.87	0.0	11.0
September	72.2	56.7	3.18	0.0	11.2
October	63.2	47.5	3.25	Trace	12.0
November	51.7	38.7	3.83	1.2	12.9
Fall	62.4	47.6	10.26	1.2	12.0

SOURCE:

Department of Commerce, 1982. National Oceanic and Atmospheric Administration: Local Climatological Data Annual Summary with Comparative Data, 1982, for General Logan International Airport, Boston, Massachusetts.

Wind Speed and Wind Direction

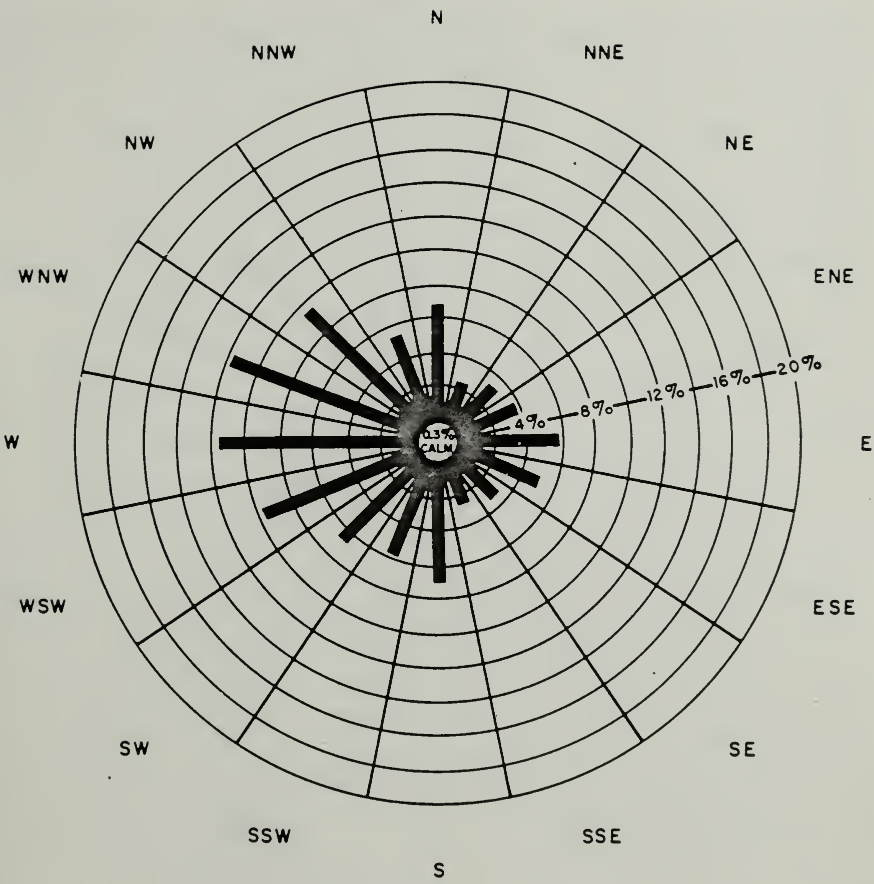
Figure 6.1.3-3 depicts the annual frequency distribution of wind direction in Boston. The most frequent (11.8 percent) wind direction is west-northwest and the least frequent (2.3 percent) wind direction is south-southeast. Figures 6.1.3-4 through 6.1.3-7 present the seasonal frequencies of wind direction at Boston. During the winter season, (December - February), the wind is predominately from the west-northwest, with the winds blowing from the west through (clockwise) northwest approximately 45 percent of the time. During the spring (March - May), the most frequent (11.5 percent) wind direction remains west-northwest. However, the frequency of wind directions from the northeast through (clockwise) southeast is significantly increased over that of the winter months because of the sea breeze phenomenon. The most prevalent (11.4 percent) wind direction during the summer is west-southwest, with the winds blowing from the south through (clockwise) west almost half (48 percent) of the time. The effect of the sea breeze on the summer frequency distribution is evident with a pronounced secondary maximum (19.5 percent) occurring between east and southeast. During the fall, the prevalent (10.6 percent) wind direction is west.

The annual average hourly wind speed is 12.5 mph. Calm conditions are infrequent (0.3 percent). Average monthly wind speeds are summarized in Table 6.1.3-2. Wind speeds are highest during the winter, reflecting the increase in the frequency of intense storms affecting New England. Wind speeds are lowest during the summer,which is the period that lacks organized large-scale storm activity, although short duration high wind gusts can occur during this season as a result of localized thunderstorm activity.

Table 6.1.3-3 presents seasonal and annual wind speeds per wind direction. A west-northwest wind direction is associated with the highest annual average wind speed of 13.9 mph and a south-southeast wind is associated with the lowest annual average wind speed of 8.5 mph. These directions correspond with the highest and lowest average wind speed directions of the winter season. During the summer, a south-southwest wind is associated with the highest wind speed of 11.7 mph.

6.1.4 AIR QUALITY

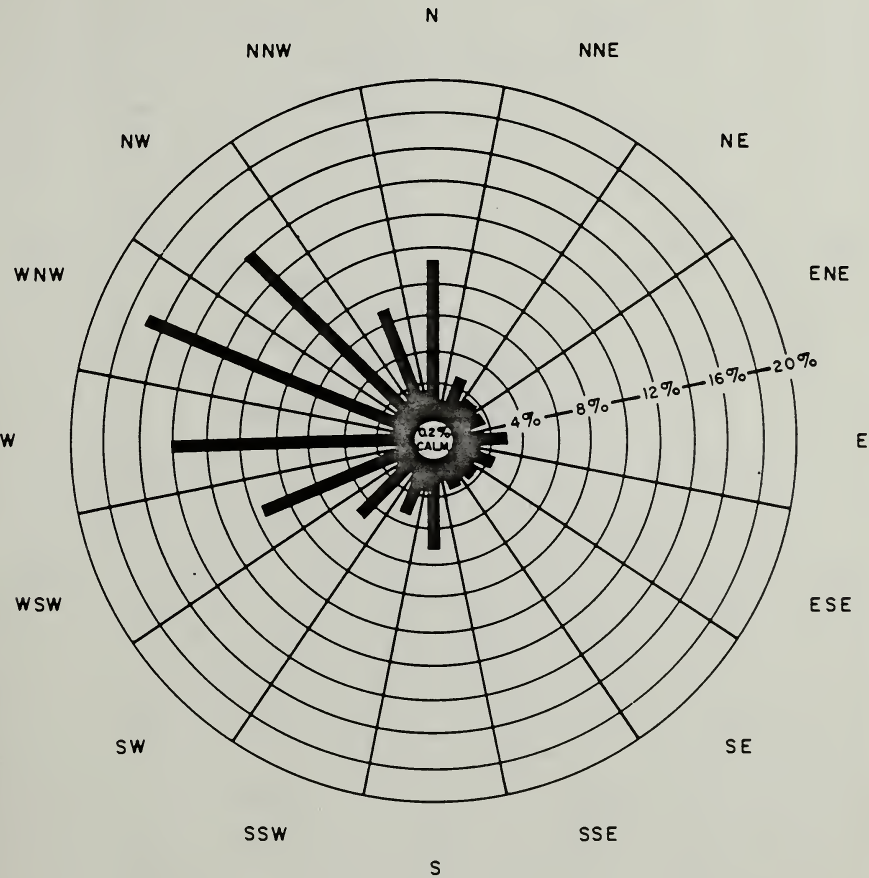
Federal and State air pollution control to date has focused on the six major pollutants for which National Ambient Air Quality Standards (NAAQS) have been established in accordance with the Clean Air Act (CAA) and its 1977 amendments. Known as the "criteria pollutants", the NAAQS include total suspended particulates (TSP), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (0_3), and lead (Pb). Non-methane hydrocarbon standards were revoked on January 5, 1983 [48FR628]. Primary standards are intended to safeguard human health by setting limits on the amount of pollution allowed in the surrounding air so as to protect the population with a significant margin of safety. The margin of safety is to ensure protection of more sensitive groups such as children, the elderly, and the ill. Secondary standards are meant to protect public welfare by preventing adverse effects on animals, agricultural crops, man-made materials and property, personal comfort and well being, and other factors. The degree of stringency of the primary standards, as opposed to the secondary standards, is dependent upon results of extensive health analyses.



NOTE
DIRECTION REPRESENTS SECTOR FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

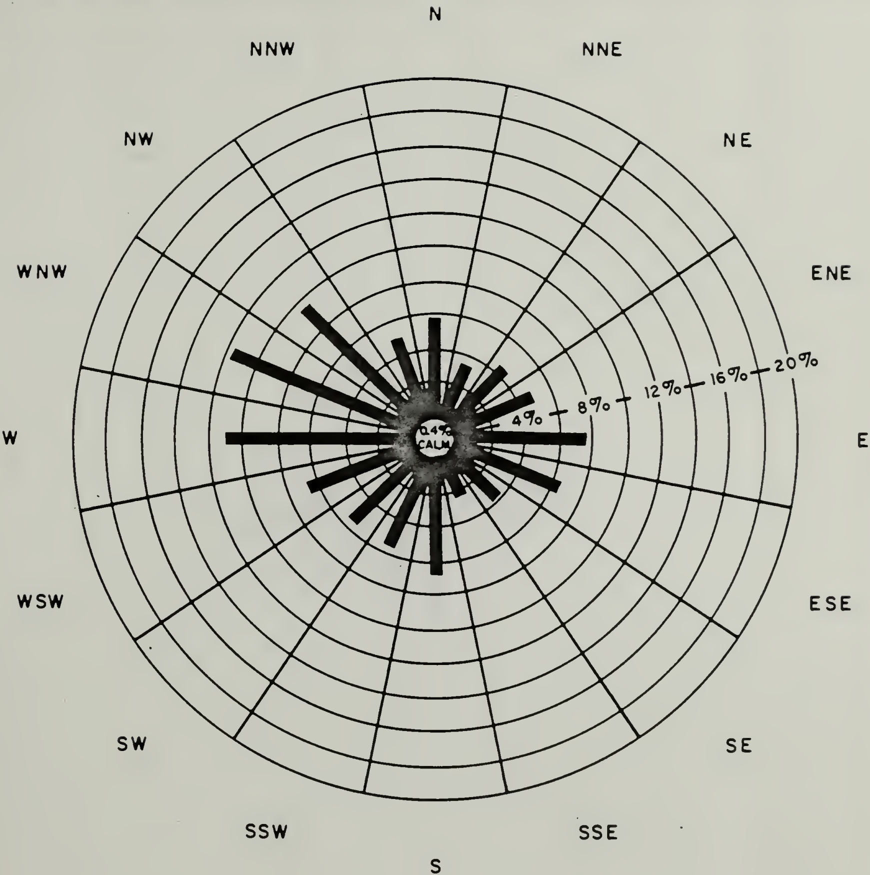
MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.3-3 ANNUAL FREQUENCY DISTRIBUTION OF WIND DIRECTION AT DEER ISLAND (1970 - 1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

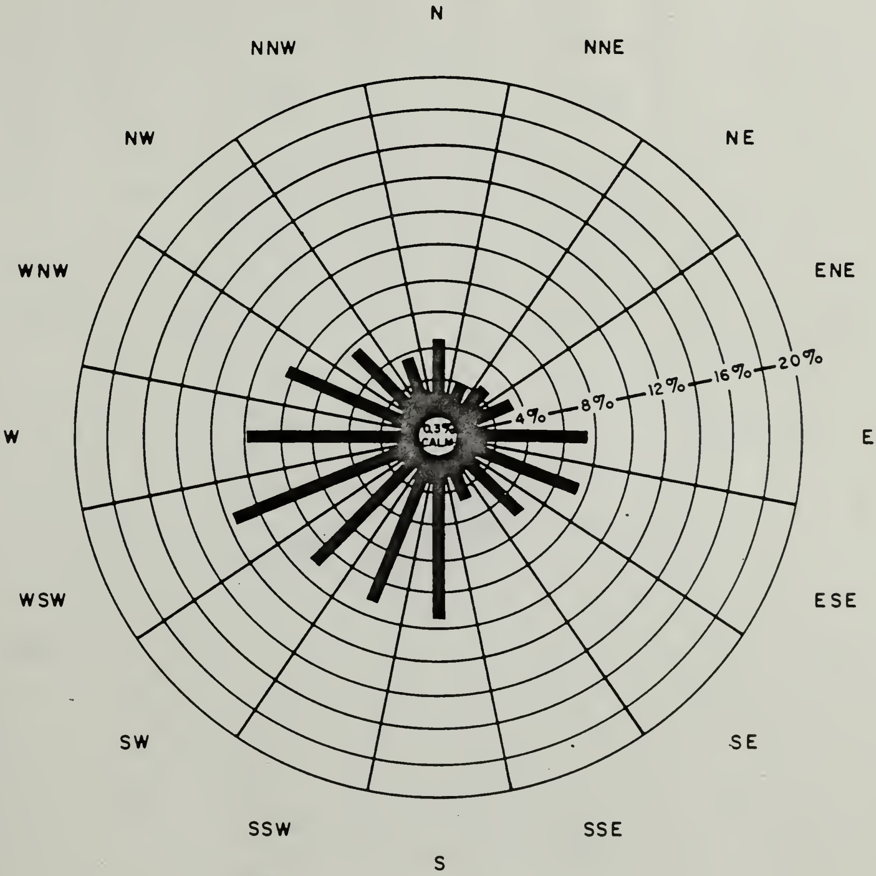
MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.3-4 WINTER FREQUENCY DISTRIBUTION OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970 - 1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

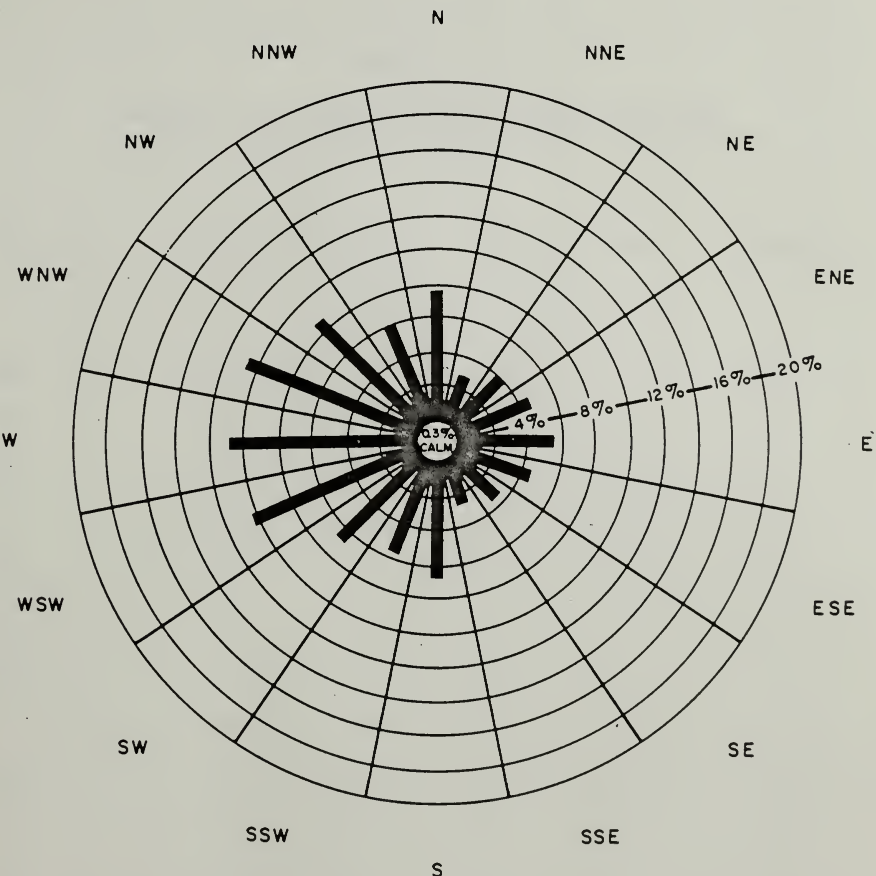
MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.3-5 SPRING FREQUENCY DISTRIBUTION OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970 - 1981)



NOTE
DIRECTION REPRESENTS SECTOR FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.3-6 SUMMER FREQUENCY DISTRIBUTION OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970 - 1981)



NOTE
DIRECTION REPRESENTS SECTOR
FROM WHICH THE WIND BLOWS

SOURCE: National Climatic Center
Asheville, NC.

MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.3-7 FALL FREQUENCY DISTRIBUTION OF WIND DIRECTION BOSTON, MASSACHUSETTS (1970 - 1981)

TABLE 6.1.3-3

SEASONAL AND ANNUAL AVERAGE WIND SPEED (MPH) PER WIND DIRECTION AT LOGAN AIRPORT (1970-1981)

Wind Direction	Winter	Spring	Summer	Fall	Annual
N	11.5	10.8	8.6	10.0	10.4
NNE	10.3	11.1	8.5	9.7	10.0
NE	12.5	12.9	10.5	12.0	12.0
ENE	14.5	12.0	9.1	11.5	11.5
E	14.0	11.6	9.7	11.0	11.1
ESE	11.5	11.7	10.2	10.3	10.8
SE	9.4	9.0	8.2	9.0	8.8
SSE	9.1	8.9	7.3	8.7	8.5
S	10.9	10.8	9.7	9.9	10.2
SSW	13.2	13.3	11.7	12.0	12.4
SW	13.4	12.7	11.5	12.0	12.2
WSW	13.5	12.1	11.1	12.1	12.1
W	15.4	14.7	11.1	13.5	13.8
WNW	15.5	14.6	11.2	13.0	13.9
NW	14.0	13.3	10.8	12.2	12.9
NNW	12.2	12.4	10.4	11.0	11.6

Under the CAA, individual states must adopt criteria pollutant standards in their State Implementation Plans (SIPs) that are at least as stringent as the NAAQS. Table 6.1.4-1 lists the Massachusetts and National Ambient Air Quality Standards. The primary method of ensuring that the standards are attained and maintained is through the control of the emissions of these pollutants, specifically from mobile and stationary sources.

In addition to criteria pollutants, the CAA requires control of other airborne compounds including radionuclides. Known as "noncriteria pollutants", regulation of these substances has been more difficult to achieve. This is due largely to the uncertainty of the origin of their emissions, the atmospheric chemistry involved during transport, and the significance, if any, of their health effects. Emissions standards for some of the noncriteria pollutants have been established (40CFR61) and are known as the National Emission Standards for Hazardous Air Pollutants (NESHAP). These hazardous air pollutants include asbestos, beryllium, mercury, and vinyl chlorides. The intent of NESHAP is to provide nationally uniform control requirements through specific emission limitations, work practices, and/or equipment standards. The NESHAP control requirements are set at a level that provides an ample margin of safety to protect the public health.

Determination of progress being achieved in attaining and/or maintaining the NAAQS is accomplished through ambient air quality monitoring. Under the CAA, the state must provide for ambient air quality monitoring at selected locations within specified areas under its jurisdiction, known as Air Quality Control Regions (AQCRs). The state must make available on an annual basis the present ambient conditions on a pollutant-specific basis. In addition to the state-operated network, ambient monitoring data are also collected by local agencies, corporations, universities, etc.

Deer Island is located in the state-designated Metropolitan Boston Air Pollution Control District and the federally designated Metropolitan Boston Air Quality Control Region 119 (AQCR). Ambient air quality monitoring data representative of the region surrounding Deer Island were obtained from the Massachusetts Department of Environmental Quality Engineering. The ambient air quality data presented in this section are essentially inclusive of the period 1981 through 1985 for the criteria pollutants. Table 6.1.4-2 lists monitoring sites, station identification (Storage and Retrieval of Aerometric Data [SAROAD] numbers, operators,pollutants monitored, and Universal Transverse Mercator (UTM) coordinates.

Ambient air quality data summaries are provided below for each criteria pollutant. Existing air quality concentrations are compared to the appropriate ambient air quality standards shown in Table 6.1.4-1. In addition, a summary of the area's attainment status on a pollutant-specific basis is provided in Table 6.1.4-3.

Total Suspended Particulates (TSP)

A summary of TSP ambient air quality data is presented in Table 6.1.4-4. No violations of primary or secondary standards were recorded during the time frame.

No ambient data depicting the TSP concentrations in the immediate vicinity of Deer Island are

TABLE 6.1.4-1
MASSACHUSETTS AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Criteria Pollutant	Averaging (Interval [1])	Primary Standard (ug/m^3)	Primary Standard (ppm)	Secondary Standard (ug/m^3)	Secondary Standard (ppm)
Sulfur Dioxide	Annual	80	0.03	-	-
	24-hr	365	0.14	-	-
	3-hr	-	-	1,300	0.5
Total Suspended Particulate	Annual	75 (2)	-	60 (2, 3)	-
	24-hr	260	-	150	-
Nitrogen Dioxide	Annual	100	0.05	100	0.05
	1-hr	320	0.19	-	-
Carbon Monoxide	8-hr	10 (5)	9	10 (5)	9
	1-hr	40 (5)	35	40 (5)	35
Ozone	1-hr (6)	240	0.12	240	0.12
Lead	3-month (7)	1.5	-	1.5	-

NOTES:

1. 1-hr, 3-hr, 8-hr, and 24-hr standards not to be exceeded more than once per year. Arithmetic mean for 3-month and annual standards except particulate matter.

2. Annual geometric mean.

3. For use as a guide in assessing implementation plans to achieve the 24-hr standard.

4. Massachusetts Department of Environmental Quality Engineering guideline, applicable only to major sources or major modifications of oxides of nitrogen.

5. Carbon monoxide standards are shown in units of mg/m^3.

6. Standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above standard is equal to or less than one.

7. Maximum arithmetic mean average over a calendar quarter.

TABLE 6.1.4-2

AMBIENT AIR QUALITY MONITORING STATIONS

Monitoring Site (SAROAD No.)	Operated By	Pollutant(s) Monitored	UTM Coordinates X	UTM Coordinates Y
1. Deer Island Boston (0240-026)	DEQE	SO_2, NO_2	337.9	4690.2
2. Atlantic Ave Boston (0240-018)	BECO	TSP, SO_2, SO4	30.8	4690.8
3. Long Island Boston (0240-019)	BECO	TSP, SO_2, SO4	337.6	4686.6
4. Bremen St.	DEQE	TSP, SO_2, NO_2, C0,0_3	332.7	4693.4
East Boston (0240-021)	BECO	TSP, SO_2, SO_4		
5. Chestnut and 6th Chelsea (0380-002)	DEQE	TSP, Pb	332.5	4695.1
6. Power Horn Hill (0380-003)	DEQE Chelsea	SO_2, NO_2, O_3	339.9	4675.8

TABLE 6.1.4-3

ATTAINMENT STATUS DESIGNATIONS OF AQCR 119

Criteria Pollutant	Area	Status
TSP	Boston	Cannot be classified or better than national standards
SO_2	Entire State	Better than national standards
NO_2	Entire State	Cannot be classified or better than national standards
CO	Boston	Does not meet primary standards
O_3	Entire State	Does not meet primary standards
Pb	Entire State	Currently no designations

TABLE 6.1.4-4

AMBIENT AIR QUALITY DATA SUMMARY
FOR TOTAL SUSPENDED PARTICULATES

Monitoring Site	Year	24Hr Average Concentration Highest (ug/m^3)	2nd Highest (ug/m^3)	Annual Geometr Mean (ug/m^3)
Atlantic Ave	1981	---	---	---
Boston	1982	---	---	---
	1983	---	---	---
	1984	177	139	56
	1985	---	---	---
Long Island	1981	---	---	---
Boston	1982	---	---	---
	1983	---	---	---
	1984	50	49	25
	1985	---	---	---
Bremen St	1981	---	---	---
East Boston	1982	---	---	---
	1983	100	95	52
	1984	107	97	40
	1985	---	---	---
Chestnut and 6th	1981	149	128	57
Chelsea	1982	118	104	50
	1983	127	106	50
	1984	125	118	54
	1985	---	---	---

presently available. TSP concentrations recorded in 1981 through 1985 at the nearby Long Island monitoring station, located less than 2 miles from Deer Island, were in compliance with all standards.

In a study performed in 1977 to determine the elemental composition of TSP in metropolitan Boston, it was reported that between 51 and 59 percent of all particulates originate from the soil and are entrained into the atmosphere by vehicle activity, construction and demolition, and the action of the wind (Wiltsee 1977). In addition, it was determined that the burning of residual oil fuel for power generation from all sources contributes only 2 to 5 percent of the TSP concentrations in metropolitan Boston.

Sulfur Dioxide (SO_2)

Ambient monitoring data for SO_2 are summarized in Table 6.1.4-5. There were no violations of either the 3-hour, 24-hour, or annual ambient standards of 1300 micro-grams per cubic meter (ug/m^3), 365 ug/m^3 and 80 ug/m^3, respectively, at any site in the vicinity of Deer Island during the period from 1981 through 1985. It is clear that SO_2 concentrations in the vicinity of Deer Island are well within all standards.

An evaluation of the trends of $S0_2$ concentrations in metropolitan Boston shows that regional levels fell consistently from 1971 to 1974, with the steepest decline occurring in the urban core. Annual average concentrations for the entire metropolitan Boston area fell from 41 ug/m^3 in 1971 to 18 ug/m^3 in 1974. At the same time, SO_2 concentrations in downtown Boston declined from 63 ug/m^3 in 1971 to 19 ug/m^3 in 1974.

The dramatic decrease in annual average SO_2 concentrations between 1971 and 1974 was a result of sulfur-in-fuel regulations. Because of the lower SO_2 ambient levels in 1974 and the increased cost of low-sulfur fuel oil, new legislation (Massachusetts General Laws of 1974, Chapter 494) allowed utilities and industries meeting specific stringent conditions (e.g., protection of standards and public health) to burn higher sulfur fuel oil. As a result, ambient SO_2 levels increased slightly between 1975 and 1978 but remained well within all ambient standards.

Since 1978, the overall annual average SO_2 concentrations in metropolitan Boston have consistently remained between 33 and 36 ug/m^3, which is only 40 to 46 percent of the annual standard. However, concentrations did vary significantly from station-to-station. Kenmore Square monitoring station, for example, has consistently recorded annual average concentrations between 50 and 55 ug/m^3, while concentrations recorded at Long Island ranged between 22 and 26 ug/m^3.

Nitrogen Dioxide (NO_2)

A summary of annual NO_2 ambient data from 1981 to 1985 is provided in Table 6.1.4-6. No NO_2 monitoring station in the vicinity of Deer Island recorded a violation of the annual standard of 100 ug/m^3. The entire region is currently designated as "better than national standards" for NO_2.

TABLE 6.1.4-5

AMBIENT AIR QUALITY DATA SUMMARY
FOR SULFUR DIOXIDE

Monitoring Site	Year	3-Hr Running Average Highest (ug/m^3)	3-Hr Running Average 2nd Highest(1) (ug/m^3)	24-Hr Daily Average Highest (ug/m^3)	24-Hr Daily Average 2nd Highest(1) (ug/m^3)	Annual Arithmetic Mean(2) (ug/m^3)
Deer Island	1981	---	---	---	---	---
Boston	1982	179	178	96	60	---
	1983	---	---	---	---	---
	1984	---	---	---	---	---
	1985	---	---	---	---	---
Atlantic Ave.	1981	359	280	191	147	41
Boston	1982	---	---	---	---	---
	1983	---	---	---	---	---
	1984	288	288	168	134	35
	1985	---	---	---	---	---
Long Island	1981	233	196	113	104	23
Boston	1982	---	---	---	---	---
	1983	---	---	---	---	---
	1984	236	210	254	238	19
	1985	---	---	----	---	---
340 Bremen St.	1981	215	204	126	102	37
East Boston	1982	364	281	128	116	37
	1983	---	---	---	---	---
	1984	279	261	171	141	34
	1985	---	---	---	---	---
Power Horn Hill	1981	---	----	---	---	---
Chelsea	1982	---	----	---	---	---
	1983	---	---	---	---	---
	1984	367	263	109	102	24
	1985	---	---	---	---	---

NOTES:

1. Standard compliance is determined by comparing the second highest recorded value to the 3-hour standard of 1300 ug/m^3 and the 24-hour standard of 365 ug/m^3.

2. Annual standard is 80 ug/m^3.

TABLE 6.1.4-6

AMBIENT AIR QUALITY DATA SUMMARY
FOR NITROGEN DIOXIDE

Monitoring Site	Year	1Hr Average Concentration Highest (ug/m^3)	1Hr Average Concentration 2nd Highest (ug/m^3)	Annual Arithmetic Mean(1) (ug/m^3)
Deer Island	1981	---	---	---
Boston	1982	433	395	60
	1983	304	234	30
	1984	---	---	---
	1985	---	---	---
Bremen St East Boston	1981	214	207	55
	1982	303	258	43
	1983	332	286	50
	1984	333	263	61
	1985	---	---	---
Power Horn Hill Chelsea	1981			
	1982			
	1983			
	1984	667	517	42
	1985			

NOTE:

1. Annual standard is 100 ug/m^3.

In addition to the State and Federal standard for annual average concentrations. Massachusetts DEQE has followed its own policy for short-term NO_2 concentrations applicable to new or modified major sources of oxides of nitrogen (NOx). Specifically, new or modified major sources of NOx that increase emissions to the atmosphere by more than 250 tons per year must demonstrate that the operation of the source will not, with consideration of ambient background, cause or significantly contribute to NO_2 concentrations in excess of 320 ug/m^3 for any 1-hour period on more than 1 day per year.

Highest and second highest 1-hour average NO_2 concentrations are provided in Table 6.1.4-6. Concentrations recorded at Deer Island and Power Horn Hill in Chelsea show some violations of the Massachusetts 1-hour guideline of 320 ug/m^3.

Ambient levels of NO_2 are primarily a result of NOx emissions from motor vehicles and stationary combustion sources. It is estimated that motor vehicle emissions constitute 45 percent of all NOx emissions, while stationary combustion sources contribute 50 percent. Electric utilities are responsible for approximately 56 percent of the NOx emissions from stationary combustion sources (EPA 1979). It follows, then, that approximately 30 percent of all NOx emissions are attributable to electric utilities. Because of their elevated stacks, stationary sources are generally far less significant contributors to ground-level ambient concentrations of NO_2 than motor vehicles.

Determination of trends in NO_2 concentrations from 1971 to 1977 is more difficult to accomplish and conclusions are probably less reliable than for the other criteria pollutants due to the sparsity of the data base and the lack of continuous measurement equipment. However, DEQE is of the belief that, based on the available non-continuous data, the ambient concentrations at almost all its monitoring stations were in compliance with the annual standard of 100 ug/m^3 for the period from 1971 to 1977 (DEQE 1978). In 1977, when continuous monitoring became more readily available, only those sites located close to heavily traveled roadways (i.e., the NOx source of most concern) were retained. From 1977 to 1981, the more reliable continuous monitoring data have not revealed any discernible trend in annual NO_2 concentrations.

Carbon Monoxide (CO)

Table 6.1.4-7 summarizes CO ambient air quality data from 1981 through 1985. No violation of the primary and secondary 1-hour standard of 40 mg/m^3 was recorded at any station during the 4-year period analyzed. However, violations of the 8-hour standard of 10 mg/m^3 have occurred at the East Boston monitoring sites.

Trend data for CO are available for the period from 1973 to 1981. These data are generally reported in terms of number of violations of the 8-hour standard, and annual average concentrations (although no annual standards exist for CO). Results show a significant and continuous decrease in both the number of 8-hour violations and annual average concentrations in metropolitan Boston throughout the period. This is directly attributable to the replacement of older, less efficient automobiles with newer models equipped with emission control systems. The continuous long-term decrease in CO concentrations is not unexpected since CO emissions are largely caused by automobile exhaust.

TABLE 6.1.4-7

AMBIENT AIR QUALITY DATA SUMMARY
FOR CARBON MONOXIDE

Monitoring Site	Year	1Hr Average Highest (mg/m^3)	1Hr Average 2nd Highest(1) (mg/m^3)	8Hr Average Highest (mg/m^3)	8Hr Average 2nd Highest(1) (mg/m^3)
340 Bremen St	1981	12	12	10	8
East Boston	1982	17	17	11	10
	1983	--	--	--	--
	1984	16	14	8	7
	1985	--	--	--	--

NOTE:

1. Standard compliance is determined by comparing the second highest recorded value to the 1-hour standard of 40 mg/m^3 and the 8-hour standard of 10 mg/m^3.

Ozone

Two monitoring stations in the general vicinity of Deer Island have collected ozone data during the 5-year period analyzed (1981-1985). One violation of the ambient standard for ozone has occurred during the period. The highest and second highest 1-hour concentrations of ozone are listed in Table 6.1.4-8. The EPA attainment status designation lists the entire area as Table 6.1.4-7 "nonattainment".

Ozone is a widespread problem, not limited to any one specific area. Ozone moves easily over great distances, and local violations are often the result of such mobility.

Ozone concentrations are in large part due to the emissions of volatile organic compounds (VOC), NOx, and, to a lesser extent, CO generated by transportation-related sources, in particular, the automobile. However, VOC emissions from industrial sources and NOx emissions from utility sources are also believed to contribute to ozone formation. Emissions of these pollutants in the presence of sunlight are believed to trigger photochemical oxidation leading to the production of ozone (EPA 1979). Although the detailed formation processes are not well known, traditional opinion in the scientific community is that ozone is formed in the stratosphere (i.e., above 7.5 miles) and transported to the ground in the vicinity of frontal zones or breaks in the tropopause which separates the stratosphere from the troposphere (Danielson 1977). Hence, local emissions of the precursor pollutants are not thought to significantly contribute to local ozone concentrations, but are instead transported downwind while undergoing the photochemical oxidation process.

The attempt at reducing ozone concentrations in metropolitan Boston and elsewhere is based on a cooperative effort by federal, state, and local agencies to limit the precursor pollutants, with the emphasis placed on the control of automotive exhaust. However, progress achieved to date in reducing ozone concentrations through control strategies is difficult to discern. Analysis of trend data (1973 through 1981), generally reported in terms of number of standard violations per year, shows no clear trend in ambient concentrations of ozone. Annual variations in the number of recorded 1-hour violations appear to be more dependent upon meteorology than any significant change in precursor emissions.

Lead

Unlike the other criteria pollutants for which standards were established during the early 1970's, the ambient standard for lead was promulgated in October 1978. The ambient standard is 1.5 ug/m^3, maximum arithmetic mean concentration averaged over a calendar quarter. In addition to the relatively recent promulgation of the lead standard, ambient air quality monitoring, data reporting, and surveillance provisions for this pollutant have been slow to evolve because of technical uncertainties. Primarily as a result of this, the existing data base for lead is limited to one site in the general vicinity of Deer Island: Chestnut and 6th Street, Chelsea. Ambient monitoring data collected from 1981 to 1985 at this site are presented in Table 6.1.4-9. No violations of the standard have been recorded at this monitoring site. Lead ambient standard attainment designations have not yet been promulgated for Massachusetts.

TABLE 6.1.4-8

AMBIENT AIR QUALITY
DATA SUMMARY FOR OZONE

Monitoring Site	Year	1Hr Average Highest (ppm)	2nd Highest(1) (ppm)
340 Bremen St	1981	0.115	0.095
East Boston	1982	0.145	0.117
	1983	0.112	0.110
	1984	0.107	0.073
	1985	---	---
Power Horn Hill	1981	---	---
Chelsea	1982	---	---
	1983	---	---
	1984	0.125	0.125
	1985	---	---

NOTE:

1. Standard compliance is determined by comparing the second highest recorded value to the 1-hour standard of 0.12 ppm.

TABLE 6.1.4-9

AMBIENT AIR QUALITY
DATA SUMMARY FOR LEAD[1]

Monitoring Site	Year	Quarter	Quarterly Arithmetic Mean[2] (ug/m^3)
Chestnut and 6th	1981	Second	---
Chelsea		Fourth	---
	1982	First	0.54
		Second	0.33
		Third	0.46
		Fourth	0.42
	1983	First	0.26
		Second	0.23
		Third	0.37
		Fourth	0.40
	1984	First	0.27
		Second	0.26
		Third	0.27
		Fourth	0.34
	1985	---	---

NOTES:

1. Federally compiled data. EPA/atmospheric surveillance.

2. Standard compliance is determined by comparing the recorded quarterly arithmetic mean to 1.5 ug/m^3.

Lead is emitted to the atmosphere by vehicles burning leaded fuel and by certain stationary sources which include lead smelters, gasoline lead additive manufacturers, and lead storage battery manufacturers.

6.1.5 LAND USE AND VISUAL CHARACTER

Land Use

Deer Island, connected to the southern tip of Winthrop, is 203 acres in size. The two active land uses are the Deer Island House of Correction, owned and operated by the City of Boston, and MWRA's existing 343 mgd primary treatment facility for the North Service area. Combined, these facilities occupy a total of approximately 60 acres toward the landward side of the island. Except for the treatment plant and prison structures, almost all of Deer Island is open space, with recreational use limited to prison recreation areas and passive recreational areas used by prison and treatment plant employees. Occasional visitors use the south end of the island for passive recreation.

Deer Island is zoned "B-1, General Business" by the City of Boston. This classification allows all commercial and residential uses, but excludes industrial or other nonconforming uses without a variance. The existing nonconforming uses of the prison and the treatment plant predate the zoning classification.

The Deer Island House of Correction has over 450 inmates with over 4,000 visitors annually. House-to-house searches undertaken in the neighborhood and the use of sirens following prison escapes (20 during 1983) have aggravated neighborhood residents. Past concerns for the prison's problems and proximity to residential areas have led to local, state and federal efforts to relocate this facility. Applicable state law requires that the House of Correction be relocated by 1989.

Although a prison and a sewage pumping station have been located on Deer Island for nearly 100 years, it was after the hurricane in 1936 that these metropolitan uses on Deer Island began to be more closely associated with the Point Shirley neighborhood. Prior to this time, Shirley Gut and its swiftly moving currents physically separated Deer Island from Winthrop. Access was by ferry. Hurricane winds and tides deposited sand and silt that connected the Island to Winthrop. This was consolidated and made into a causeway permanently linking the two areas. Loss of the Gut reduced the flushing action around Deer Island and brought the island into closer association with the Town of Winthrop (even though Deer Island remained a part of the City of Boston).

The Point Shirley and Cottage Hill neighborhoods are the closest communities to Deer Island. They are situated on a narrow peninsula, with Point Shirley connected to Deer Island and separated from Winthrop by a causeway. The neighborhoods are predominantly residential with approximately 450 residences and a population of about 1000 people in Point Shirley and about 1400 residences and approximately 3400 people in Cottage Hill. A majority of the homes, originally built as summer cottages, have been winterized and are used on a year-round basis. Most major commercial activity in Winthrop is located along the main truck route to Deer

Island. Zoning in Point Shirley, Cottage Hill and throughout much of Winthrop is "Residence A, Single Family Use."

The construction of a sewage treatment plant by the MDC in the 1960's was initially perceived as a positive development in the neighborhoods. Over time, the increasing lack of funds for maintenance has resulted in a gradual deterioration of this facility.

Areas surrounding Deer Island can be characterized as residential in Winthrop to the northwest, transportation-oriented at Logan International Airport to the west, open/institutional on Long Island and the President Roads shipping channel to the south, and open water (Broad Sound and the Atlantic Ocean) to the north and east.

Traffic

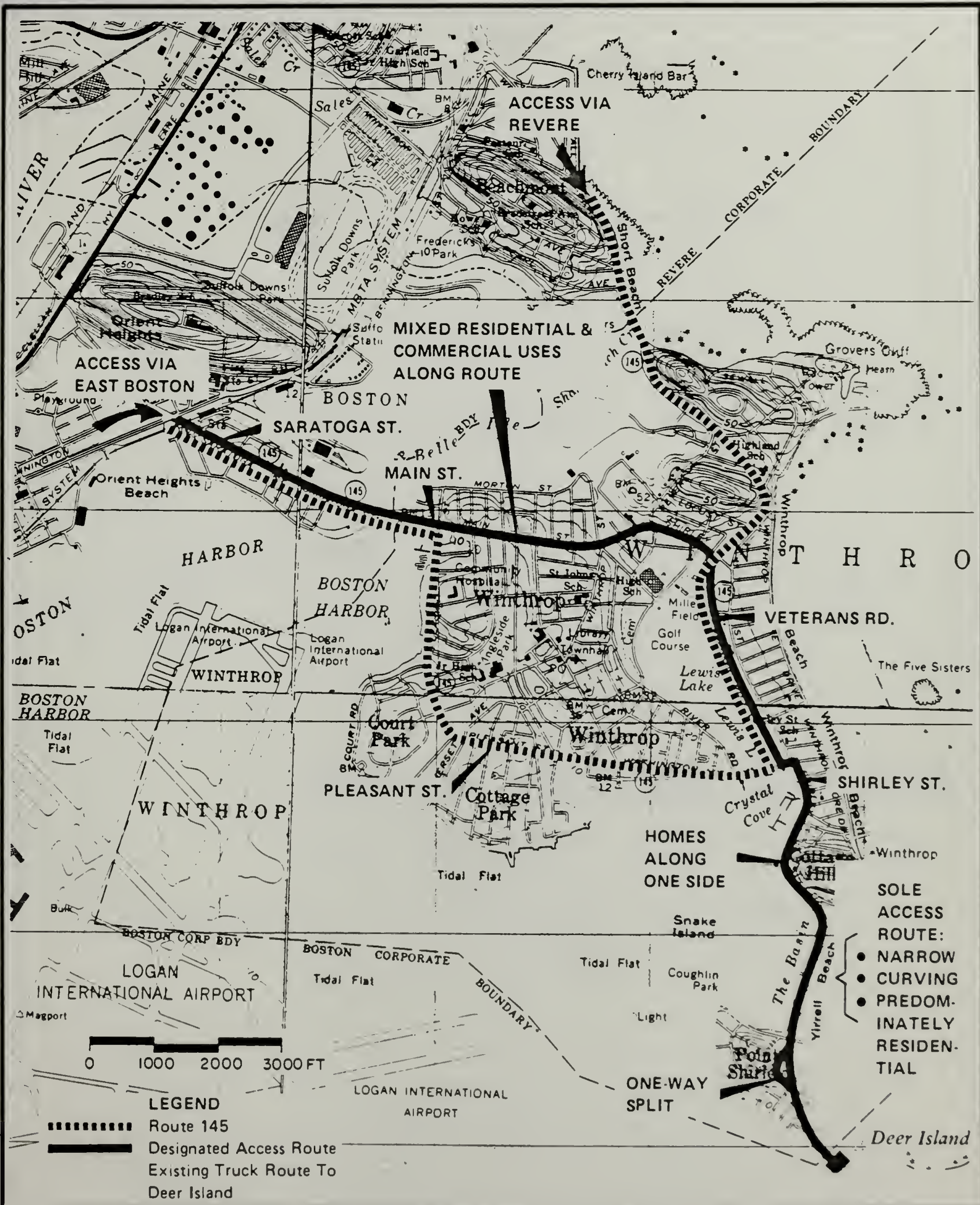
Land access to Deer Island is available by only two routes as shown in Figure 6.1.5-1. The major access route is via Saratoga Street in East Boston. This becomes Main Street in Winthrop at the bridge crossing Belle Isle Inlet. An alternative route is through Revere via Winthrop and Shore Drive. Both roadways are part of Route 145. However, only the Winthrop route is open to trucks along its entire length (designated as the truck route to Deer Island). Along the designated truck route, there is a 33 ton load limit for the bridge on Saratoga Street.

The traffic capacity of the predominantly two-lane local urban streets in the vicinity of Deer Island is approximately 1600 vehicles per hour (total for both directions). Present traffic flows on local roads are in the range of 150 to 625 vehicles per hour (total for both directions). Traffic volume data for 1984 and 1985 are shown in Table 6.1.5-1. While local roads have more than adequate excess capacity to accommodate additional construction traffic, there is often congestion at certain intersections during the morning and evening rush hours. Calculations performed in the Final Environmental Impact Report, based on U.S. Department of Transportation Level of Service Criteria, indicate that long delays can be expected during the evening peak hour traffic at several intersections along the routes to Deer Island as shown in Table 6.1.5-2 (MWRA 1986).

Visual Character

With an elevation at the summit of 210 ft. (MDC SD), the drumlin is the dominant natural feature on Deer Island. Although it has been altered by activities related to the treatment plant and the military, it is still a prominent visual feature, defining and characterizing Deer Island from locations on-shore and in the Harbor.

A visual analysis of the Island was performed by Jung-Brannen Assoc. in 1986 as part of this study. It identified six visual zones within Boston Harbor -- the inner harbor, Dorchester Bay, Quincy Bay, Hingham Bay and two clusters of islands: Gallop, Lovells, George's Island and the Brewsters (Jung-Brannen, 1986). Two major gateways and three minor gateways to the Harbor were evident. Deer Island and Long Island frame the major Atlantic gateway to the



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.1.5-1 ACCESS ROADWAYS TO DEER ISLAND

TABLE 6.1.5-1

WINTHROP TRAFFIC FLOW DATA, 1984 AND 1985

1984 Data (EPA 1984)

Location	2-Way ADT	2-Way DHV	2-Way AM Peak Hr.	2-Way PM Peak Hr.
Washington St.	7,700	625		
Veterans Rd.	2,700	225		
Shirley St.				
S. of Washington	6,700	525		
N. of Washington	1,900	150		
Revere & Cross	4,700	370	260	358
Pontos & Petrel	5.300	420	272	343

1985 Data (MWRA 1985)

	One-Way ADT		One-Way AM Peak		One-Way PM Peak	
Location	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB
Main St.	6,668	6,349	365	577	614	405
Veterans Rd.	1,194	1,715	81	97	96	146
Shirley St.						
S. of Washington					285	324

TABLE 6.1.5-2

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	≤ 5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	> 60.0

Level-of-service A describes operations with very low delay, i.e., less than 5.0 sec per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-service B describes operations with delay in the range of 5.1 to 15.0 sec per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-service C describes operations with delay in the range of 15.1 to 25.0 sec per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-service D describes operations with delay in the range of 25.1 to 40.0 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high *v/c* ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-service E describes operations with delay in the range of 40.1 to 60.0 sec per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

Level-of-service F describes operations with delay in excess of 60.0 sec per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high *v/c* ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

TABLE 10-3. LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

RESERVE CAPACITY (PCPH)	LEVEL OF SERVICE	EXPECTED DELAY TO MINOR STREET TRAFFIC
≥ 400	A	Little or no delay
300–399	B	Short traffic delays
200–299	C	Average traffic delays
100–199	D	Long traffic delays
0– 99	E	Very long traffic delays
*	F	*

* When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement to the intersection

Level of Service at Intersections (Table Numbers Above Refer to Tables in the Highway Capacity Manual, U.S. DOT 1985).

outer harbor, while Logan International Airport and Castle Island frame the second major gateway between the inner and outer harbor. Nut and Peddock Islands create a minor gateway between Quincy Bay and Hingham Bay. The other two minor gateways do not impact the MWRA project area.

Based upon the identification of landmarks, zones of vision were drawn from the near and distant viewpoint landmarks. It was determined that near views to Deer Island were available from various places in Winthrop, Logan Airport, Castle Island, and the islands to the south. Distant views are available from the office towers of downtown Boston and Back Bay, the JFK Library in Dorchester, from the shores of Nahant, and from the point at Hull High School. From the water, three types of craft have views of the site: commercial ships in the main channels; passenger ferries that follow designated routes; and recreational craft that can view the site from several points.

6.1.6 NOISE

Noise associated with the construction and operation of the new Deer Island secondary wastewater treatment plant has the potential to impact several portions of the Town of Winthrop. To minimize noise impact, noise control requirements will be incorporated into the treatment plant facilities planning process through the use of noise evaluation criteria. These criteria will be employed to judge the effectiveness and acceptability of noise controlling alternatives as they apply to wastewater treatment equipment, site planning, and construction. The existing regulatory and environmental factors that constitute the basis for developing the noise evaluation criteria are summarized in this section.

Regulatory criteria that address noise control, as well as assessments of potential impacts, rely on evaluations of baseline noise levels for judging the magnitude and acceptability of incremental noise changes. Several baseline noise surveys have previously been made within the Point Shirley study area. These surveys sampled ambient noise for periods of a few minutes up to 24 hours.

This section characterizes existing noise within the study area, and describes a more extensive study that was conducted during this facilities plan to provide a firm statistical basis for the development of recommended noise criteria for Deer Island. The results of this survey, and recommendations for construction and operational noise criteria, are summarized herein.

Regulations and Guidelines

The assessment of noise impact involves determination of both the expected increase in ambient noise and the means of compliance with appropriate regulations. Three noise regulations are potentially applicable to the site. These are the City of Boston Noise Regulations, the Massachusetts Department of Environmental Quality Engineeering (DEQE) guidelines, and the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) standards. These three regulations are summarized as follows.

The City of Boston's noise regulations address various sources of noise and set specific noise limits for the transmission of sound between properties of the same and different zoning. The allowable noise transmitted to a residential zone during the daytime hours of 0700 to 1800 (7:00 a.m. to 6:00 p.m.) is 60 dBA. A 50 dBA level is allowable during the remaining nighttime hours. The maximum allowable noise allowed to be transmitted to an industrial site is 70 dBA. The code also has corresponding octave band level requirements.

The Boston noise code limits construction noise at the residential and institutional property lines to an L10 (the level exceeded 10 percent of the time) of 75 dBA and a maximum level of 86 dBA. The allowable L10 for recreational land is 80 dBA. Construction is not permitted at night or on weekends unless the construction noise level at the residential property line does not exceed 50 dBA.

The State of Massachusetts Department of Environmental Quality Engineering (DEQE) guidelines on noise allow a new facility to increase the ambient noise a maximum of 10 dBA over the existing L90 ambient noise, i.e. the level exceeded 90 percent of the time. The L90 levels to be used are the lowest values measured at night. The DEQE guidelines also prohibit the emission of a pure tone from noise sources. A pure tone is defined as occurring when the level in one octave band exceeds the level in the two adjacent octave bands by 3 dB or more.

All equipment on the site will be required to conform to the OSHA requirements on noise exposure. These regulations allow an equivalent 8-hour exposure of 90 dBA for the protection of employee hearing. Where equipment cannot be purchased to meet OSHA noise exposure requirements, noise mitigation must be added as required.

Previous Ambient Sound Level Surveys

At least five previous ambient sound level surveys associated with the Deer Island treatment facilities have been conducted in the Deer Island area. These surveys are summarized in Table 6.1.6-1. The surveys collected statistical sound level samples of a few minutes to an hour in duration, and in one instance, 24 hours. Measurements were usually collected at several locations. These measurements were used for making preliminary assessments of anticipated noise impact for the facility.

However, as part of secondary treatment facility planning and environmental reviews, a more extensive data base was desired. Ambient noise is a statistical quantity which not only varies diurnally, but also from day to day. Both the perceived noise impact and the allowable level as required by the DEQE are based on an assessment of the existing ambient sound level. A sampling program which continuously monitored ambient sound levels 24 hours a day for a total of 17 days was conducted. This large sample of ambient sound levels provides a broad base for assessing the existing ambient levels.

TABLE 6.1.6-1

SUMMARY OF PREVIOUS AMBIENT SOUND LEVEL SURVEYS
CONDUCTED IN WINTHROP FOR THE WASTEWATER TREATMENT PLANT

CONDUCTED BY	DATE	REPORTED IN
Metcalf and Eddy	1982	Site Options Study, Vol. II 1982.
Havens and Emerson	4-3-84	Supplemental Draft Environmental Impact Statement/Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Vol. 2.
Thibault and Bubly Associates	6-12-85	Noise Analysis (To EPA).
Cavanaugh Tocci Associates	9-11-85 9-25-85	Supplemental Draft Enviornmental Impact Statement/Report on Siting of Wastewater Treatment Facilities for Boston Harbor. Vol. 2, Appendix.
C.E. Maguire, Inc.	7-1-86	Notice of Project Change, On-Island Water Transportation Facilities, 7-31-86.

Ambient Sound Level Survey

For this study, an ambient sound level survey was conducted at Point Shirley, in the Town of Winthrop, as the nearest area potentially impacted by facility construction and operation noise. The goals of the survey were to:

1) Establish the spatial variation in the ambient sound levels throughout Point Shirley.

2) Establish the diurnal variation in the sound levels.

3) Determine the temporal variability of sound levels from day to day.

4) Identify the sources of noise controlling these levels.

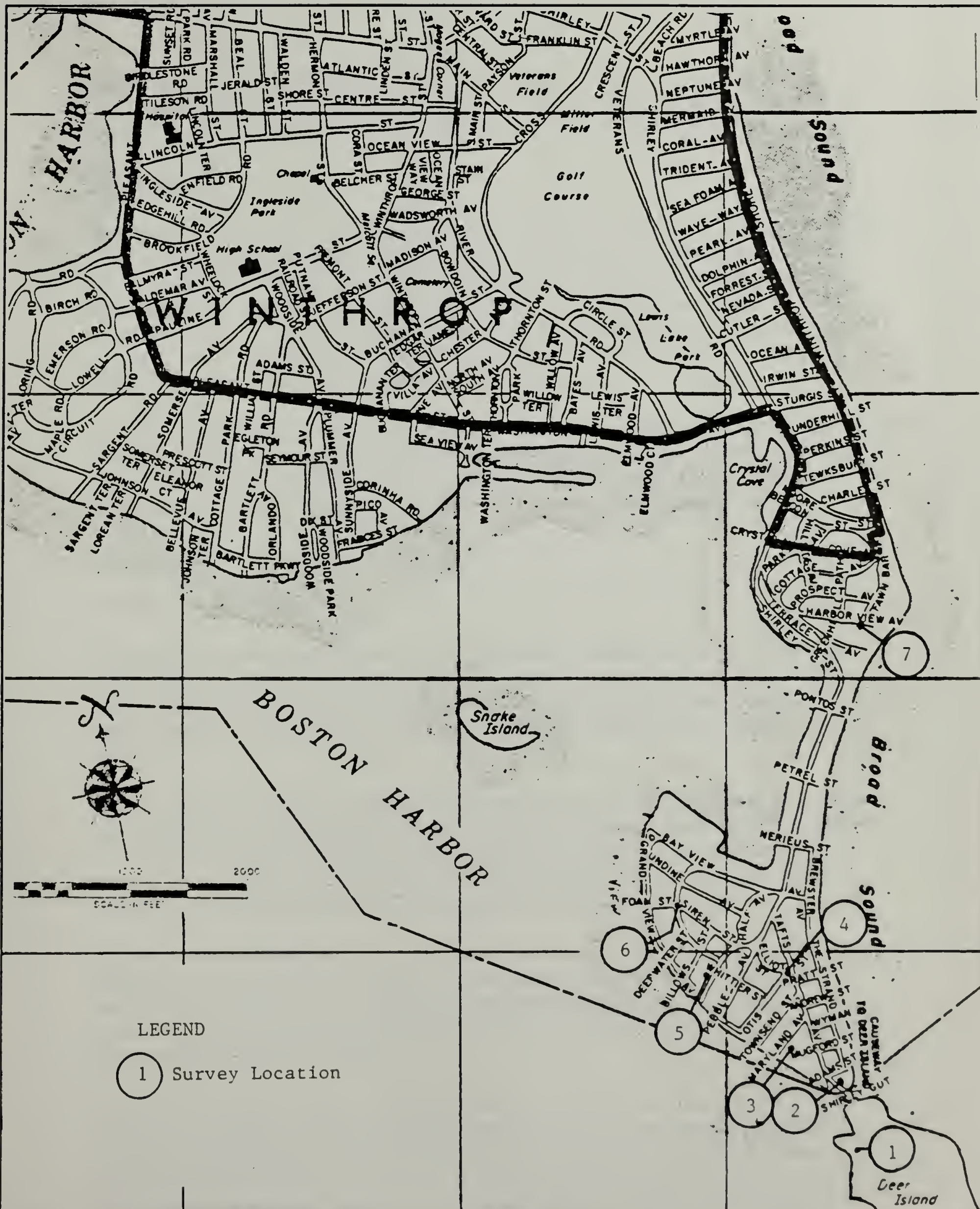
Measurement Locations and Methodologies

A preliminary inspection of the study area indicated that the primary noise sources were Logan Airport, traffic on Tafts Street and other local roads, surf noise from the beaches, and occasionally the existing treatment plant. Previous studies also indicated that the Nordberg diesel drives on the existing wastewater pumps were sometimes audible. These previous studies also assessed the sound levels throughout Winthrop and concluded that the mainland portion of Winthrop had nighttime L90 levels in the 34 to 40 dBA range, whereas Point Shirley was slightly louder, in the 40-43 dBA range. Since the distances to the other parts of Winthrop are greater, the criteria selected for Point Shirley will also serve as conservative criteria for the balance of Winthrop.

Measurement locations were selected to provide data on each of the sources discussed in the previous paragraph, as well as to be spatially distributed across Point Shirley. A map of the locations is given in Figure 6.1.6-1. All of the locations except No. 1 have line-of-sight shielding by houses from the airport and surf. Location 1 was shielded by a house from the diesel pump station. Locations 2 and 3 had line-of-sight visibility to the diesel pump station.

Two types of noise survey methodologies were utilized which, when used in conjunction with each other, provide a complete description of the spatial and temporal variation in sound levels. The first type consisted of the continuous statistical monitoring of sound levels, in a sequential manner, at locations 1 and 3, as shown in Figure 6.1.6-1. A total of 17 data days were taken sequentially at these locations. Locations close to the plant were selected for the continuous monitors because the potential for noise impact is the greatest close to the site. The monitor was periodically calibrated throughout the survey.

The second type of survey was staffed, and measurements were taken with portable instrumentation. During these surveys, 10-minute statistical samples of sound level data were always taken, and on three out of five of the surveys, residual octave band measurements were also taken. The staffed surveys enable a number of locations to be measured in a relatively



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.6-1 AMBIENT SOUND LEVEL SURVEY MEASUREMENT POSITIONS, WINTHROP MASSACHUSETTS, SEPTEMBER 1986

brief period of time, along with observations of the sources of noise. The staffed surveys were conducted during 2- to 3-hour periods during the day and night at locations 1, 2, 4, 5, 6, and 7. The staffed survey results are given in Appendix C, Tables C-1 through C-5.

Instrumentation

Two types of instruments were used for measuring the ambient sound levels. A Larson-Davis 800 Noise Analyzer and a Bruel and Kjaer 2215 sound level meter were used manually to measure octave band sound pressure levels and A-weighted sound level statistics. The residual octave band measurements are taken in the absence of transient noise such as passing vehicles and aircraft landings. Ten-minute statistical samples of the A-Weighted sound level were taken by reading the meter every 10 seconds and preparing a histogram of the data. All manual measurements were taken with local winds less than 10 mph.

The second type of instrument used was a Larson-Davis 700 Noise Dosimeter, which continually measures and statistically analyses the variable ambient noise. The device was programmed to provide hourly statistics including the L10, L50 and L90 values. The L90 value typically represents the residual or background level which occurs when transient noise is absent.

Survey Results and Discussion

Manually Collected Data

The manually-collected data discussed above is presented in Appendix C, Tables C-1 through C-5. Most of the L90 sound level data taken some distance from the water (locations 4, 5, and 6) were determined to be in the 42-47 dBA range. Measurements taken from locations that are more exposed to surf noise, such as locations 1, 2, 3, and 7, were sometimes several decibels higher.

During the day and evening, the quiet intervals between aircraft takeoff and landing noise were observed to be infrequent and brief. However, after the hours of approximately 2300 to 2400 (11:00 p.m. to midnight), takeoffs and landings became infrequent and the residual levels appeared to be controlled by surface aircraft operations at Logan Airport, surf noise, and occasionally the Nordberg diesels of the treatment plant wastewater pumps.

In general, the more sheltered locations, i.e. those away from the shore, were 5 or 6 dBA quieter than those near the water because they were partially shielded from Logan ground operations, surf, and occasional diesel noise. This was directly observed in the field by measuring noise primarily from surface aircraft operations, and then moving behind a house to block the line of sight to the airport.

The pump station diesels were inaudible at all locations when the winds were northerly. This is because the vertical gradient in wind speed tends to raise the upwind sound wave off the ground and creates a shadow zone. However, when the winds had a southerly component, i.e. from the direction of the diesels, the diesels were occasionally audible at one or two measurement locations which varied from survey to survey. Diesel audibility is indicated in Appendix C.

Tables C-1 to C-5.

When audible, the diesel sound varied in an irregular, pulsing manner caused by multiple diesel units operating at slightly different speeds. Most of the diesel noise was in the 63 Hz octave band corresponding to the cylinder firing rate. At one of the measurement locations the diesels caused a 4 dBA variation in the sound level on "fast" response. The level in the 63 Hz band on "fast" response varied from 5-10 dB. On "fast" response the meter's response time is reduced and the meter becomes very sensitive to rapid changes in sound level. All other measurements were taken on "slow" response as is standard practice for community noise measurements.

Continuous Monitor Data

A tabulation of the data from the continuous monitor used first at Location 1 and then at Location 3 is given in Appendix D. This data describes the diurnal variation in sound level for 13 days at Location 1, and 5 days at Location 3. The data from the two locations are very similar and are analyzed together.

The L90 data were divided into meaningful time periods and sorted to examine the group statistics. The L90 sound levels for the nighttime period of 2300 to 0600 (11:00 p.m. to 6:00 a.m.) were grouped together and sorted to determine their percentiles of exceedence. During this period of time, it is likely that a significant percentage of the population would be sleeping.

This analysis indicates that, during 50 percent of the time, the nighttime L90 values were greater than 45 dBA, indicating that 45 dBA is a typical value for the nighttime L90 sound level. The 90 percentile value of the L90 sound level at that location exceeds 39 dB. The lowest hourly L90 measured was 35 dBA at location 1.

A similar analysis was performed for the daytime hours of 0700 to 1800 (9:00 a.m. to 6:00 p.m.). This time period includes the most common periods of construction. The quietest hour during this period was at 41 dBA. However, 90 percent of the time the L90 levels were in excess of 45 dBA, and 50 percent of the time they exceeded 51 dBA. These measurements generally agree with the previous shorter-term assessments on noise on Point Shirley.

Recommended Criteria

Two noise assessment criteria are required: one for assessing the noise from daytime activities such as construction and operation of the facility; and one for assessing the nighttime operation of the facility. These criteria differ because the ambient sound level changes from day to night.

The nighttime L90 sound level is generally used to assess nighttime noise impact. However, when a large sample of L90 data is collected, it becomes necessary to statistically select a representative L90 value. In order to be conservative, the 90 percentile value of the

nighttime L90 values was selected for assessing nighttime noise impact. In other words, 90 percent of the nighttime L90 values exceed this value.

It is recommended that 39 dBA be used to assess the maximum nighttime noise impact at the property line. Other portions of Winthrop are much further in distance from Deer Island, and will receive adequate protection with this same criterion. This would also result in a DEQE requirement of 49 dBA for the allowable 10 dBA above ambient stipulated in Massachusetts DEQE Regulation 10 of the Air Pollution Regulations. It is not suggested that a 49 dBA level is the design goal, but rather that this level is a legal requirement that the site must, and will, meet as a maximum.

In a similar manner, the criterion for assessing daytime noise impact was determined to be 45 dBA. Since the lowest ambient noise levels occur during the middle of the day and the middle of the night, the maximum impact assessment criteria remain essentially the same during the evening as during the day.

In summary, the ambient sound levels (L90) for assessing maximum nighttime and daytime noise impact in the Point Shirley area are 39 and 45 dBA, respectively, as shown in Table 6.1.6-2. Predicted construction and operation noise will be compared with these levels in future analyses to determine the need for noise mitigation. The DEQE level not to be exceeded for constant nighttime operation noise is 49 dBA.

6.1.7 TERRESTRIAL AND AQUATIC ECOLOGY

Deer Island

Descriptive information for Deer Island was derived from a review of literature relating to the Island and from site visits. Literature reviewed is listed in the references and as specific credits given in the text. Site visits were made by Stone & Webster ecologists in 1976 and again in 1986.

Site Conditions

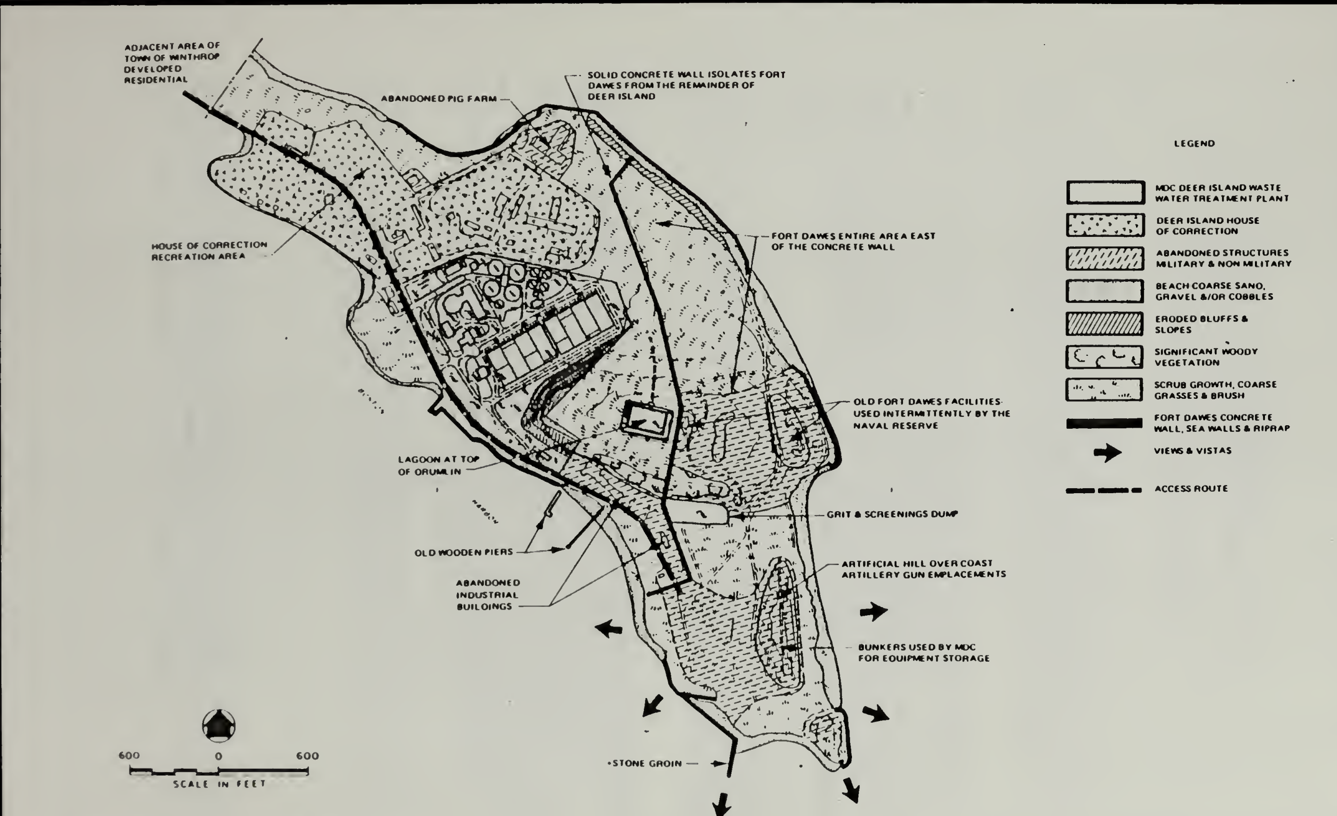
Deer Island is a large island of about 210 acres, dominated by a large grass covered drumlin over 100 feet high (Figure 6.1.7-1). This drumlin, like many features of the islands in the harbor, is a geological formation resulting from the accumulation of till, clay and other materials flushed from beneath the ice sheets of 10,000 years ago. Prior to European settlement, the island probably had a community of deciduous forest, with stands of pines also common (Metcalf & Eddy 1982). Because of the relatively isolated nature of the island site, and its exposure to wind and sea salt, any change in the nature of the ecosystem takes a long time to repair itself. Thus, the historical land uses of the site have drastically altered the native vegetation. The present conditions tend to favor communities which form as a fire subclimax (Metcalf & Eddy 1982). These conditions include:

TABLE 6.1.6-2

SUMMARY OF RESIDUAL SOUND LEVELS, POINT SHIRLEY, TOWN OF WINTHROP

	L90
Daytime 0700-1800 (7:00 a.m. - 6:00 p.m.)	45 dBA
Nighttime 2300-0600 (11:00 p.m. - 6:00 a.m.)	39 dBA

	Criteria
DEQE nighttime operation noise limit, no pure tone	49 dBA
DEQE daytime operation noise limit, no pure tone	55 dBA
OSHA on-site 8 hour exposure limit	90 dBA



SOURCE. Melcalf & Eddy, June 1982

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.1.7-1
DEER ISLAND EXISTING CONDITIONS

- Topography that favors rapid drying
- Regeneration from undamaged underground plant parts
- Porous soil
- Seeds enclosed within fire resistant woody fruits

Flora

Most of the present day site is either used for urban (commercial/institutional) activities or is covered with a scrub growth of coarse grasses and brush. The northwest portions of the island are primarily occupied by the existing waste treatment plant and are vegetated, if at all, by scattered grasses and forbs.

Scrub areas along the western side of the island to the south of the sewage treatment plant are primarily old fields dominated by ragweed (Ambrosia artemisifolia). In the low, damp areas, ragweed exceeds 1.5 meters in height. Wild carrot (Daucus carota), chicory (Cichorium intybus), and goldenrod (Solidago spp.) are also abundant. Along the concrete wall, field bindweed (Convolvulus arvensis), common tansy (Tanacetum vulgare), dwarf cinquefoil (Potentilla canadensis), snowy campion (Silene nivea) and bittersweet (Solanum dulcamara) are common.

North-northwest of the old pumping station, the slope rises steeply. The growth in this area is approximately one meter high and dominated by grasses. Ragweed, wild carrot and milkweed were found at the base of the slope. The walkways around the buildings of the pump station were overgrown with numerous other forbs.

The slope above the pumping station is an abandoned orchard, dominated by apple (Pyrus sp.), black cherry (Prunus serotina) and staghorn sumac (Rhus typhina). On the central and southern sections of the island is an old field dominated by unidentified grass species (Gramineae). Rabbit's-foot clover (Trifolium arvense), daisy fleabane (Erigeron sp.), common burdock (Arctium minus), milkweed (Asclepias sp.) and bouncing bet (Saponaria officinalis) were also present. This area also contains scattered clumps of trees of diverse mixtures including black cherry, Indian bean (Catulpa sp.), quaking aspen (Populus tremuloides), cottonwood (Populus deltoides), sugar maple (Acer sacchrum) and others.

To the east of the Fort Dawes concrete wall, the island is primarily grassland. The area contains scattered shrubs such as bayberry (Myrica pensylvanica), in occasional clumps with giant reed (Phragmites sp.) in the low areas.

Fauna

The varied nature of the site presents an equally varied habitat for wildlife species. On the west slope of the drumlin, the old field vegetation and the clumps of pioneer tree species all present sufficient cover and forage for numerous bird and mammal species.

Mammals - Reconnaissance of the island revealed that a number of mammals frequent the area. Cottontail rabbits (Sylvilagus sp.) and striped skunk (Mephitis mephitis) have been observed on the island (Table 6.1.7-1). Raccoons (Procyon lotor) and numerous rodents have been found on the island (Boston Harbor Comprehensive Plan 1972).

Birds - A number of bird species have been observed on the island (Table 6.1.7-1). Pheasant (Pasianus colchicus), red-winged black bird (Agelaius phoeniceus), bluejay (Cyanocitta cristata), plovers (Charadriidae), herring gulls (Larus argentatus), great black-backed gulls (L. marinus), swallows (Hirundinidae), and crows (Corvus brachyrhynchos) were observed on the island. Of particular note was the sighting of three sparrow hawks (Falco sparverius) hunting over the island. The presence of three raptors in the area suggests the presence of ample game in the form of insects and rodents (S&W Mgt. Cons. 1976).

Reptiles and Amphibians - Few or no amphibian or reptile species are expected to inhabit the island because of lack of suitable habitat.

Endangered and Threatened Species

No endangered or threatened species are known to inhabit Deer Island. The U.S. Department of Interior (USDI) list of species protected under the Endangered Species Act of 1973, as amended, contains only four species of terrestrial vertebrates whose geographic range includes Massachusetts (USDI 1986).

Mammals - The Indiana bat (Myotis sodalis) has been recorded in a single locality in Massachusetts (Chancy 1976). Although no individuals have been found in many years, it may still occur in the emery mines in Hampden County, Massachusetts. The mines have been given to the Massachusetts Division of Fisheries and Wildlife in an effort to protect remnants of the bat's population. It is unlikely that this species would be found on Deer Island.

Birds - The Bald Eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrins tundris and F. p. anatum) are all listed as endangered. The bald eagle is characteristically a bird of seacoasts, large remote lakes and river shores. Today, no known breeding populations are found in the state. However, a hacking program by state and federal wildlife agencies (28 eaglets in five years at the Quabbin Reservoir) has reintroduced the bird to Massachusetts (Dyer 1987). The program is scheduled to continue for another three years.

The 1987 winter bird survey found 42 eagles (possibly including a few golden eagles) in the Quabbin Reservoir area and 54 eagles state wide (Dyer 1987). So far none has nested in the area, but sexual maturation takes five years and nesting may occur in the next few years. Although it is highly unlikely that bald eagles will ever nest in the harbor islands, even with an increase in their numbers, because of the levels of human activity (Dyer 1987), there is now the possibility of eagles visiting the area while migrating to other parts of New England.

Native breeding populations of the peregrine falcon have been completely extirpated throughout the eastern U.S., and the arctic peregrine now occurs in the region as a spring and fall migrant. However, the American peregrine falcon has also been successfully reintroduced along the east coast and in particular in Boston (Horwitz 1986). It is the only species listed by the Federal government as endangered which is likely to be found near Deer Island. A pair of peregrines, a three year old Boston male and a three year old Canadian female, have taken up residence on the McCormick Courthouse Building in Post Office Square and have successfully nested (French 1987a). This is the first successful nest in Massachusetts in 36 years (French 1987b). These birds hunt primarily in the Boston Harbor Islands and thus have a high likelihood of visiting Deer Island.

Of the vertebrates listed in Massachusetts as "threatened" (Ritzer and Franzen 1975), only one species, the Ipswich sparrow (Passercules princeps), could occur in the area of the harbor islands. The sparrow, classified as a subspecies of the Savannah Sparrow, breeds only on Sable Island off the southern coast of Nova Scotia. It winters along beaches, sand dunes and coastal marshes from Massachusetts to Georgia.

Sensitive Communities

The Massachusetts Natural Heritage Program (Michaud 1987) has no record of any rare plant or animal species or unusual plant communities on Deer Island. National Wetlands Inventory maps show no freshwater wetlands on Deer Island, other than the wastewater treatment plant reservoir at the top of the drumlin (USDI 1987). No wetlands qualifying under M.G.L. Chapter 131, S40 were found during the site visits.

Environmental Stress

Major environmental stress which can alter growth and development of biota includes plant diseases, insect pests, pesticides, fire, drought, winds, ice and snow, agriculture activities, air pollution, recreational activities and, occasionally, vandalism. Deer Island has served as a site for a variety of municipal facilities dating back to colonial times. It was the site of an internment camp for hostile Indians, a reformatory, and a quarantine hospital, and it has served as the outlet for the metropolitan area's sewage since the late 1860's. It also was the site of a cemetery and burial areas.

A majority of Deer Island has been subjected to extensive modifications and disturbance, particularly within the last 100 years. The most extensive have included the construction of concrete bunkers, radar and radio facilities and access roads. Related grading of slopes associated with Fort Dawes (1941) disturbed a substantial amount of the drumlin and land areas to the south. The subsequent construction and modifications of the Deer Island Treatment Plant (1968) added to this disturbance over the central part of the island. The prison and prior uses in the northern part of the site had previously disturbed the area to the north and northwest of the drumlin. The treatment plant reservoir at the top of the drumlin is operated by MWRA.

Table 6.1.7-1

LIST OF FLORA AND FAUNA OBSERVED AT DEER ISLAND

WOOD SCRUB

Type	Scientific Name	Common Name	Occurrence*
Trees	Pyrus sp.	Apple	Abundant
	Prunus serotina	Black cherry	Abundant
	Prunus sp.	Cherry	Common
	Catalpa sp.	Indian bean	Infrequent
	Rhus typhina	Staghorn sumac	Common
	Rhus glabra	Smooth sumac	Common
	Populus tremuloides	Quaking aspen	Infrequent
	Populus grandidentata	Bigtoothed aspen	Infrequent
	Populus deltoides	Cottonwood	Infrequent
	Acer sacchrum	Sugar maple	Infrequent
	Acer rubrum	Red maple	Infrequent
	Crataegus sp.	Hawthorn **	Infrequent
Shrubs and Vines	Rubus canadenisi	Blackberry	Common
	Vitis sp.	Grape	Infrequent
	Asparagus sp.	Asparagus	Infrequent
	Rose sp.	Rose	Infrequent
	Myrica pensylvanica	Bayberry **	Infrequent
	Spiraea sp.	Spirea	Common

OPEN FIELD

Type	Scientific Name	Common Name	Occurrence*
Forbs	Daucus carota	Wild carrot	Abundant
	Ambrosia artemisiifolia	Common Ragweed	Abundant
	Solanum dulcamar	Deadly nightshade	Common
	Datuar strumonium	Jimson weed	Infrequent
	Solidago spp.	Goldenrod	Common

Note: * Abundant - Frequently found, wide distribution
Common - Often found, scattered distribution
Infrequent - Seldom found, scattered distribution

** Old Field Vegetation

	Cichorium intybus	Chicory	Common
	Tanacetum vulgare	Common tansy	Common
	Trifolium arvense	Rabbit's foot clover	Infrequent
	Potentilla canadensis	Dwarf cinquefoil	Infrequent
	Asclepias sp.	Common milkweed	Common
	Gramineae	Grasses	Common-Abundant
	Convolvulus arvensis	Field bindweed	Common
	Saponaria officinalis	Bouncing bet	Common
	Silene nivea	Snowy campion	Common
	Arctium minus	Common burdock	Infrequent
	Erigeron sp.	Daisy fleabane	Infrequent
	Petunia sp.	Petunia	Infrequent
	Solanum sp.	Tomato	Infrequent
	Linaria vulgaris	Butter and eggs	Common
	Phragmites sp.	Giant reed	Common

FAUNA

Mammals	Sylvilagus spp.	Cottontail rabbit	Common
	Mephitis mephitis	Striped skunk	Common
	Procyon lotor	Raccoon	Infrequent
	Rodentia	Mice and voles	Common-Abundant
Birds	Agelaius phoeniceus	Red-winged black bird	Abundant
	Cyanocitta cristata	Bluejay	Common
	Corvus brachyrhynchos	Crow	Common
	Larus argentatus	Herring gull	Abundant
	Larus marinus	Great black-backed gull	Common
	Hirundinidae	Swallow	Abundant
	Charadrius sp.	Plover	Common
	Pasianus colchicius	Ring-necked pheasant	Common
	Falco sparverius	Sparrow hawk	Common

Because of the extensive land modification caused by more than 100 years of periodic construction activity on Deer Island, very little area on the island has been untouched. As a result, there are no pristine or mature habitats on the island or on its shores, and vegetation present on the island consists mainly of weedy invasion species.

Section 6.1.7 References

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6.1.8 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

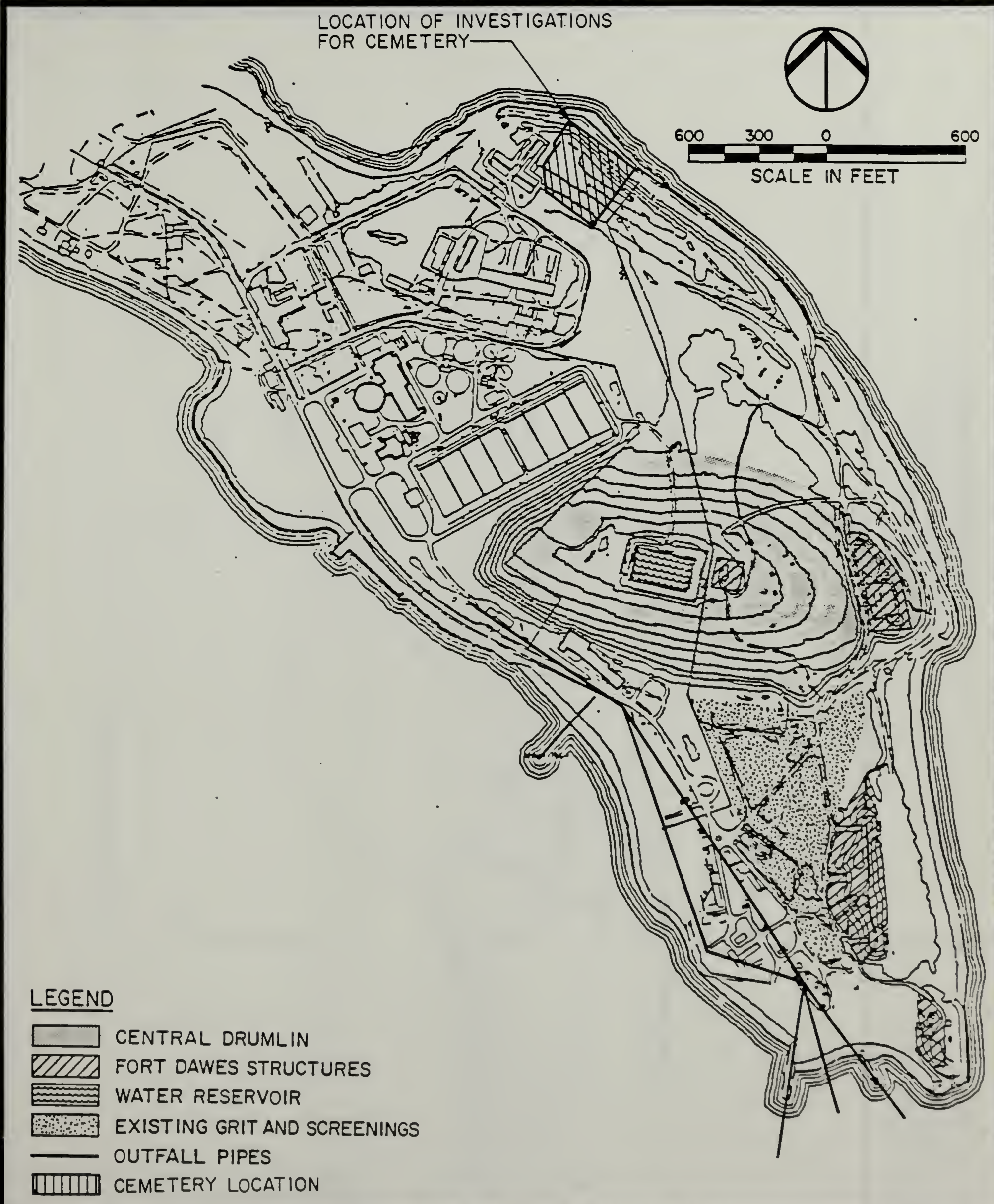
The proposed construction of new wastewater treatment facilities on Deer Island would require most of the available space (about 200 acres) on Deer Island. This area would probably include that part of the northern end of Deer Island now occupied by the Deer Island House of Correction. As part of the siting process for this project, a reconnaissance level archaeological survey was conducted by Public Archaeological Laboratory, Inc. (PAL) in September 1985 to identify and document cultural and archaeological resources as well as to assess the extent of previous disturbance within the designated project area. In addition, Boston Affiliates undertook an historic structure survey of Deer Island in October 1985. A cemetery plot and associated vault were identified are located on a slope on the northeast side of the island between the old piggery and the concrete boundary wall that originally separated the City of Boston property from the U.S. military reservation on the southern half of Deer Island (Figure 6.1.8-1). It is referred to hereafter as the northeast, or new, cemetery. In addition, the Deer Island House of Correction complex and the old MDC Deer Island Pumping Station were indicated as eligible for listing in the National Register of Historic Places.

The subsequent archaeological and historical studies required to further document these early findings in accordance with Section 106 of the National Historic Preservation Act of 1966 (NHPA) are discussed below. Section 106 is a Federal review process designed to ensure that historic properties are considered during Federal project planning and execution. The review process is administered by the Advisory Council on Historic Preservation (ACHP), an independent Federal agency.

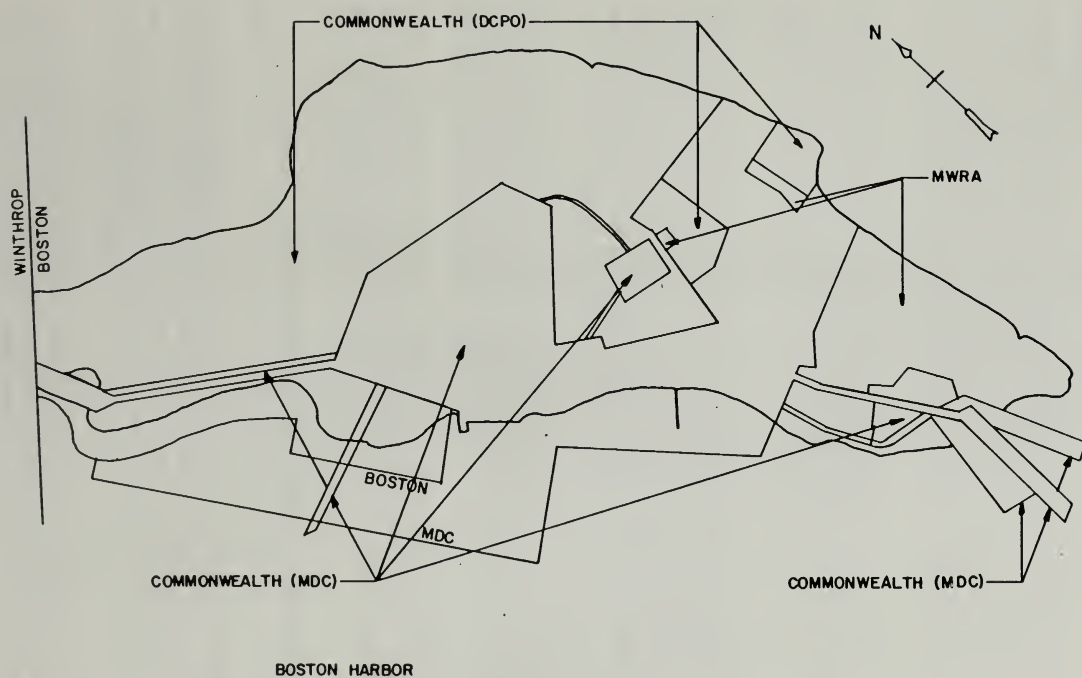
Archaeological Survey

A more intensive archaeological survey was carried out in 1987 by PAL to assess the significance of the historic period cemetery. The survey was carried out in two basic stages: documentary research followed by site verification.

The specific objectives established for the documentary research were: (1) to establish the period of active use of the cemetery identified during the reconnaissance survey; (2) to establish whether this cemetery is older than the 1908 mausoleum associated with it; (3) to determine, if possible, whether the known cemetery contains any burials that were removed from earlier nineteenth century plots formerly located on other sections of Deer Island; (4) to determine if the cemetery plot near the 1908 mausoleum could contain older (nineteenth century ?) reinterred burials; (5) to consult records maintained by the military (Army Corps of Engineers) for any information relevant to the final disposal of burials from Resthaven Cemetery on the southern tip of Deer Island; (6) to determine when Resthaven Cemetery was first actively used by the correctional facilities; and finally, (7) to locate documentary sources describing the methods used in the burial of almshouse or prison inmates on Deer Island



MASSACHUSETTS WATER RESOURCES AUTHORITY	FIGURE 6.1.8-1 LOCATION OF CEMETERY



MASSACHUSETTS
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FIGURE 6.1.8-2
PROPERTY OWNERSHIP
ON DEER ISLAND

(individual graves, large trenches, etc.).

Historic Survey

Deer Island contains two groups of historic structures. One is the complex of buildings that comprise the Deer Island House of Correction. Buildings in this prison complex span from 1850 to the 1950s. The earliest structure is the Deer Island Almshouse, now much altered and used as the Administration Building. The Hill Prison, dating from 1904, is substantially intact. The Superintendent's House, now used as an office, dates from a later period. In addition to these, there are numerous small twentieth century buildings that make up the complex.

The Deer Island Pumping Station, built in stages from 1894 to 1899, is no longer used. Its masonry elements and roof are in substantially sound condition, but the building is now open to the weather, and interior machinery has rusted and deteriorated. An adjacent wooden farmhouse building, also abandoned, appears in fair condition structurally, although also exposed to the elements.

The Fort Dawes complex was built by the U.S. Department of Defense on the southeastern section of the island between 1941 and 1943. It consisted of a series of concrete bunkers, gun emplacements, a small observation tower, and a radar station on top of Signal Hill. It was never used to house troops or munitions. The Fort is now under the jurisdiction of the U.S. Navy, having been placed under "caretaker status" in 1946. The Massachusetts Historical Commission has not mentioned Fort Dawes as having historic significance.

Boston Affiliates first undertook an historic survey of the Deer Island House of Correction and Pumping Station complexes in October, 1985. This survey was submitted to the Massachusetts Historical Commission (MHC) with a request for its opinion on the eligibility of these structures for the National Register of Historic Places.

MHC responded that it believed that the Hill Prison and Superintendent's House in the Deer Island House of Correction complex, as well as the Pumping Station and Farmhouse, would be eligible for the National Register. Since MHC considers these structures eligible, a Section 106 review had to be undertaken.

In order to comply with applicable state and federal legislation, the following steps were taken.

Determination of Eligibility. The first step was to apply for a determination of eligibility, presenting all of the facts relevant to the structures' history and significance. This work has essentially been done; however, some gaps in historical information have to be filled during this project in order to update the determination of eligibility and facilitate the evaluation of project alternatives.

Assessment of the Project's Effect. The effect of the project on the eligible structures on Deer Island must be indicated. Since the proposed plant may necessitate the demolition of several of these structures, the effect would be considered adverse, and will require a

consultation with MHC.

Preliminary Case Report and Consultation. As a way of assembling all the facts on the case, a preliminary case report is being prepared to describe the proposed treatment plant, assess the adverse effect, and discuss alternatives to mitigate that effect.

Subsequently, a consultation will occur among representatives of the EPA, MWRA, MHC, and other interested parties. The consultation will focus on alternative ways of accomplishing the purposes of the undertaking without unacceptably damaging the structures eligible for the National Register.

Various mitigation measures will be considered to lessen the impact of the project. Among them might be modification of the project layout to lessen its impact, moving the buildings, or documenting for archival purposes those structures that must be destroyed or substantially altered. If the agreed-upon mitigation measures include archival documentation of the structures, the Historic American Engineering Record (HAER) and the Historic American Building Survey (HABS) will be consulted on the level of documentation required and a proposal will be prepared for carrying out the documentation.

HAER has established different levels of documentation. Level 1 documentation consists of measured drawings, archival quality photographs with large-format negatives of the structure as it exists today, archival quality photocopies of historic views or drawings of the structure, and a historical report describing the structure and explaining its significance. Level 2 documentation omits the measured drawings but requires the other components.

Memorandum of Agreement. If the consulting parties are able to agree on measures to mitigate the adverse effects, they will sign a Memorandum of Agreement containing the stipulations that specify how the undertaking will be carried out. If the parties cannot agree, the case will be referred to the ACHP for its opinion.

Institutions like those on Deer Island have long and complex histories, particularly when the operation of such facilities has shifted between various city departments or from city to state or federal agencies or jurisdiction. Of primary importance to this research were documents of the different City of Boston boards of directors, committees and departments which have controlled the numerous Deer Island institutions during the past 140 years. Included among these were Annual Reports of the Public Institutions and Penal Institutions departments, the Houses of Industry, Reformation and Correction, the Overseers of the Poor, the Harbor Master and the City Auditor. The documents were located in the Massachusetts State Library and provided much valuable information.

Unfortunately, although daily and weekly reports of the immediate supervisors of the institutions (including specific information concerning inmates admitted and discharged, physical examinations, visitors to the institutions, and log books of the Houses of Industry and Correction) were located, they were not readily accessible. Many of these documents, some 318 volumes, discovered in the old prison building following a fire, were only sketchily inventoried by Dr. Dennis P. Ryan and Mr. Earl Hamilton in 1985 prior to their transfer to the

library at Boston College for preservation and cataloging (Penal Department Communication 1985). Cataloging and indexing of the collection has not yet been completed. Dr. Ryan, who has looked through much of the material, could not remember seeing any listings of deaths, burial locations, or information on cemeteries (Dr. Ryan, personal communication, 1987). Mr. Hamilton provided information concerning a "Death Book" maintained at Deer Island. However, as yet, permission has not been received to visit the island and consult this potentially valuable resource.

In addition to the consultation of city documents, the records of the U.S. Army Corps of Engineers at the National Archives and Records Administration Center in Waltham, Massachusetts were examined. The numerous memos, letters and documents relating to the purchase of the military reservation on the southern portion of the island for harbor defense and the subsequent transaction between city and military officials, provided detailed information on the old City of Boston Cemetery located on the military reservation.

Letters were mailed and/or phone calls made to individuals and departments concerned with or knowledgeable about Deer Island. Among those contacted were Captain Swanson of the Metropolitan District Commission, Earl Hamilton of the Penal Institutions Department, Superintendent Broderick and Mrs. Bondar at the Suffolk County House of Correction on Deer Island, the Cemetery Division of the Parks and Recreation Department, Death Section of the City Clerks Department, and Dr. Dennis P. Ryan, a historian of the Boston Irish and consultant to Burns Library at Boston College.

In addition to these primary sources of data, secondary sources on Boston history, Irish immigration, and other related issues were consulted. These sources provided much of the historical background necessary to understand the public institutions established on Deer Island and the inmates who occupied them.

Working within these constraints, this research has focused on the issue of death and burial at the Deer Island institutions to trace the origins and history of the cemeteries on the island. Historical background on the development of the various public institutions is provided to complete and complement this research goal.

Public Institutions on Deer Island

During the 140 years since the City of Boston took possession of Deer Island in 1847 for "sanitary purposes", the island has served as a repository for individuals and a location for institutions considered undesirable within the core urban area.

More than 25,000 alien passengers, many of them Irish immigrants, arrived in Boston during 1847 (Abbott 1926:589). The numbers of ill and dying arriving in Boston were so great that, during the summer of 1847, a receiving room was constructed at Long Wharf in which these invalids could wait for transportation to hospitals. That year, a quarantine hospital was established on Deer Island for the express purpose of receiving alien passengers "as a precautionary measure to ward off a pestilence that would have been ruinous to the public health and business of the city" (Massachusetts Senate Doc. 46, 1848:10).

Large numbers of these immigrants who were sent to Deer Island never recovered. Of 4,816 persons admitted between the opening of the hospital in June, 1847 and January 1, 1850, 4,069 were sick when admitted and 759 died on the island (Abbott 1926).

In 1849, the City of Boston confirmed its earlier decision to use Deer Island as "the place of quarantine for the Port of Boston" (City Doc. 27, 1849:5). All ships entering Boston Harbor containing passengers or cargo considered to be "foul and infected with any malignant or contagious disease" were required to anchor at Deer Island until such time as the Port Physician gave permission to leave following removal of passengers and cleaning and purification of the vessel (City Doc. 27, 1849:6).

Prior to 1849, the city maintained only one institution on Deer Island, a quarantine station and hospital for immigrants and paupers unable to care for themselves which was located on the southern half of the island. Beginning in that year, most of the Deer Island facilities were "occupied as an appendage to the South Boston establishment" of the House of Industry (City Doc. 25, 1849:4). As of March 31, 1849, the Deer Island Department of the House of Industry had 396 inmates. The hospital continued at Deer Island until 1866 when it was replaced by a new hospital on Gallop's Island (Mikal 1973:50).

A brick building was completed in 1852 to house the Deer Island Almshouse and House of Industry, located on the northern half of the island. While these two institutions were considered separately in much of the official documentation, a major problem on the island was the close association of the two categories of inmates. The Almshouse was established to serve the virtuous or deserving poor, and these individuals were permitted to live at Deer Island when they were unable to support and care for themselves. Facilities provided for the Almshouse population included a nursery, schools, hospital (shared with other institutions), housing, and workshops.

The inmates of the House of Industry were sentenced by the courts to serve time at Deer Island for misdemeanors and crimes committed in the City, including large numbers of individuals sentenced for drunkenness and idleness. This second category of inmates, the sentenced or vicious poor, were seen as a bad influence on the Almshouse population and on the children within the institution (City Doc. 27, 1857:7; City Doc. 25, 1860:5). However, it was not until construction of additional facilities to relieve overcrowding during the latter half of the nineteenth century that a more or less total separation of the two groups of inmates was accomplished. Meanwhile, the population of those institutionalized grew quickly from the 331 recorded in 1856 to 1,746 inmates in the combined institutions in 1886.

In addition, as early as 1854, Deer Island was being considered for the location of a new House of Correction. In that year the Committee on Public Buildings authorized a portion of the brick building, then housing the Almshouse and House of Industry, to be remodeled by the addition of cells, for use as a prison facility (City Doc. 24, 1856:3). As a result, inmates of the building were redistributed among the other structures on the island, most of them "inadequate and incommodious" (city Doc. 27, 1857:6). In November of 1858, the building was

completed and the city poor in the House of Industry were moved into it from the wooden buildings. At this time, a portion of the building was also allocated for the use of the House of Reformation. No prisoners from the House of Correction were yet sent to the island.

During the summer of 1858, the House for the Employment and Reformation of Juvenile Offenders-Boys was transferred from South Boston to new quarters at Deer Island. Boys sentenced for misdemeanors such as truancy, larceny and idleness were sent here for discipline (Snow 1971:156). Shortly thereafter, in the fall, a school for girls was established in the House of Industry and became known as the House of Reformation-Girls. Between 1866 and 1873 neglected children were transferred to the Almhouse facilities (Bradlee 1976:9-12). Also present on the island at this time, to serve the needs of children, were the Pauper Boys and Pauper Girls Schools within the Almshouse, serving the deserving poor. Until 1869/1870, the children were housed with the men and women of the institutions. After that date, with construction of new facilities, boys and girls were not only separated from each other, but also from the adults.

The year 1877 saw a number of changes in the population and institutions at Deer Island. Adult female paupers were removed to Austin Farm. The pauper and neglected boys were removed to the Marcella Street Home in Roxbury. This helped to relieve the crowded conditions at the main building. The only paupers remaining at Deer Island Almshouse following this reorganization were the young children in the nursery, pauper girls, and a few adult females too ill to be transferred with the rest (City Doc. 49, 1877:18).

In 1882, a House of Correction was established at Deer Island with the transfer of some inmates from the House of Correction in South Boston. Young men were sent to Concord Reformatory, and the rest went to Deer Island. The House of Correction was not considered a reformatory, but "merely a place of punishment and detention" (City Doc. 9, 1887:34). Men were employed in many occupations on the island, i.e., farming, stone cutting and manufacturing a number of items.

In Chapter 536, Section 9, of the Acts of 1896, the institution formerly known as the House of Industry on Deer Island "was established as a Suffolk County Institution, and designated as the House of Correction at Deer Island" (City Doc. 14, 1897:1). A new cell building was completed about this time, providing 500 additional cells. It was not until 1902 that the last of the inmates housed in the House of Correction in South Boston were moved to Deer Island and the consolidation completed. After this date the House of Correction was the only City of Boston institution located on Deer Island. All other inmates in the Almshouse and schools had been moved to other locations.

In 1906, following negotiations between the City of Boston and the U.S. Government, the City deeded nearly 100 acres in the southern portion of Deer Island to the federal government for the construction of a military reservation and harbor defenses (Suffolk Co. Registry Book 3177:577). Included in the stipulations of this transfer was the agreement that the City would build a boundary wall between City and military reservation property, remove the old piggery and other City property, discontinue cultivation and removal of sand, gravel and sod, and discontinue burials in old Resthaven Cemetery on the new military reservation property (U.S. Army Corps of Engineers).

A sewage treatment plant was constructed on the island in 1889 with a major outlet into the harbor built at the south end of the island. In the 1950's some 39 acres of land adjacent to the prison facilities on the south end were taken by the Metropolitan District Commission for an "antipollution and sewer project" (City Doc. 17, 1957:3). The resulting sewage treatment plant was completed in 1968.

Documents of the City of Boston indicate that through time Deer Island has become the final resting place for large numbers of individuals. During the forced occupation of Deer Island by "friendly" or "Christian" Indians during King Phillip's War in 1675, many of these Native Americans died. As they were not allowed to leave the island, burial of the dead presumably took place on Deer Island. Sweetser (1883:195) stated that of "500 martyrs to English distrust very many died, and were sadly buried by the moaning and misty sea." The locations of such burials was not recorded and is unknown. No evidence of Native American burials has been recovered from archaeological surveys on the island.

Prior and subsequent to King Phillip's War, Deer Island was leased by the City of Boston to a number of individuals or families (Snow 1971:199-203). The records do not provide any details regarding deaths or interments on the island by any of these tenants. None of the early maps of Deer Island indicate locations of burials or cemeteries.

Since 1847, when the City of Boston took possession of Deer Island "for sanitary purposes", the island has been the home of various public institutions for the care of both adult and juvenile ill, poor homeless, and sentenced offenders as described above. As such, it has also been the site of many deaths and subsequent burials of the unclaimed dead. It is on the burials and cemeteries associated with the institutions that this research focused in the effort to determine the dates, identities, methods of burial, and institutional affiliations of the interments in the new cemetery.

The initial years of the Quarantine Hospital and Almshouse at Deer Island were the period of the major influx of Irish immigrants fleeing the potato famine and disease in Ireland. Between 1847, when the institutions were established, and the end of 1849, some 4,816 persons had been admitted. Of this total number, 4,069 were ill upon their arrival at Deer Island and 759 died on the island (Abbott 1926:598). Some 721 individuals were buried on Deer Island during the years 1847-1849. These interments appear to have been made in the old Resthaven Cemetery, located on the southern portion of the island, later owned by the U.S. government (U.S. Army Corps of Engineers 1908). The discrepancy between the number of deaths and the number of burials most likely indicates that some bodies were claimed by family or friends for burial elsewhere, while only the unclaimed or indigent were buried at city expense on the island.

From the initially large numbers in 1847 to 1854, deaths and burials on the island declined sharply between 1854 and 1855 along with the drop in immigration to Boston. The number of burials remained low through the Civil War years, increasing in the mid 1870's. The reason for this increase remains unclear, although general economic conditions were bad, possibly leading to greater numbers of poor being sent to the Almshouse and House of Industry.

Deaths and burials on the island decreased with slight fluctuations through the end of the nineteenth century. This reduction in the number of deaths and burials on Deer Island can probably be linked to improved sanitary conditions and health care as well as to the change in the composition of the institutionalized population. Prior to 1896, persons residing at Deer Island institutions were a varied group of men, women and children, many of whom had been living in exteme poverty conditions and were in poor physical condition, if not ill, upon their arrival. After 1896, the population at Deer Island was primarily composed of inmates in the House of Correction who had been sentenced for crimes committed, but had not necessarily been poor or ill before their arrival. In general, this latter population was healthier than those who had preceded them on Deer Island.

The records available, primarily Annual Reports of the various city committees and departments in charge of the institutions on Deer Island, provide little information about the manner in which deaths, funerals and burial were handled on the island. Even the reports of the Chaplains at the institutions fail to mention deaths or burials. Only one Chaplain's report was noted which mentioned that "funeral and baptismal rites have been attended to when called upon" (City Doc. 14, 1897:51).

Burial on Deer Island was mentioned indirectly in several annual reports referring to construction activities related to burials and cemeteries. In the "Annual Report of the Directors of the House of Industry and Reformation, for the Year 1856-1857" construction of new tombs was reported:

> The Tombs, originally located on the north easterly face of the Island, being found unsuited to their purposes, from their exposure to flooding by the action of the sea in severe storms, have been discontinued; and the material used in the construction of new ones in a more secure and suitable position. (City Doc. 40, 1857:4)

Construction of the new tombs was in an undisclosed location. In addition, during the same year, labor was expended in "digging graves for reception and depositing the bodies removed from City of Boston" (City Doc. 40, 1857:21). There is no explanation provided about how many graves were dug or where, nor reason given for why these bodies were removed from Boston for burial on the island.

A morgue was built on Deer Island in 1886 for the use of the various institutions as needed. The annual report for that year refers to the morgue as:

> A neat and appropriate house ... for temporary deposit of the bodies of those who may die, with room for showing the bodies to friends, and where funeral services can be performed when they are not removed for burial in other grounds (City Doc. 9, 1887:38)

Where bodies were buried if unclaimed and not removed from the island was not mentioned in the report. The first mention found in city documents and annual reports of the presence of a cemetery on Deer Island came in the 1909 "Annual Report of the Penal Institutions Department." This report, which post-dates the sale of the southern portion of Deer Island from the City of Boston to the U.S. Government, makes reference to city compliance with one of the stipulations

in the deed of transfer.

> Owing to the taking of the land from the institution by the United States Government the creation of a new cemetery and receiving tomb was made necessary. and these have been completed. All the bodies in the old cemetery have been carefully transferred. (City Doc. 29, 1909:8).

The old cemetery referred to is "Resthaven (City of Boston) Cemetery at Deer Island" located on the military reservation property, southeast of the gate through the concrete boundary wall separating the City and Federal property on the southern end of the island.

A document and letter on file in the U.S. Army Corps of Engineers records provides information about Resthaven retrieved from City records in 1908 (U.S. Corps of Engineers, 1908).

> [Captain Fredendall] secured from the City of Boston the records showing the number of bodies interred therein and dates thereof, which show that this cemetery has been used for the burial of all immigrants dying at the quarantine station or brought in from ships from 1847 to 1882, since which date it has been used for burial of criminals dying at the penal institutions, City of Boston, not claimed by relatives or friends.

Fredendall's letter further indicates that in 1908 Resthaven Cemetery contained 4,160 bodies "interred in lots of eight or ten in trenches."

If "all the bodies" in the old Resthaven Cemetery were removed to the new cemetery, presumably to the cemetery on the northeast hill behind the prison and between the piggery and the boundary wall, this new cemetery would have contained 4,160 bodies as of its creation in 1908. Subsequent deaths and burials of institution inmates would have added somewhat to that number.

Unfortunately, conflicting evidence exists in the U.S. Army Corps. of Engineers records suggesting that only the eighteen bodies deposited in old Resthaven Cemetery in 1908, after the final sale of the property, were transferred to the new northeast cemetery. This is substantiated by a letter from the Master of the Suffolk County House of Correction on Deer Island dated December 30, 1908. Master Cronin reported that the 18 bodies in question, those placed in Resthaven subsequent to the sale, had been removed (U.S. Army Corps of Engineers 1908). His letter does not indicate that "all the bodies" were transferred as stated in the annual report. This conflicting evidence raises some questions as to the exact number of bodies in the newer northeast cemetery.

A further question relating to this new northeast cemetery concerns how long it was in active use following its creation in 1908. No additional mention of its presence or use was noted in subsequent city documents. A 1923 map of the city property on Deer Island, which accompanied a report considering relocating the State Prison to the island, showed all existing and planned structures, but did not indicate the cemetery plot nor the associated receiving tomb. It seems unlikely, though possible, that if the plot was in active use, its existence would be omitted from this planning document. This leaves some doubt as to whether bodies were being buried in

the cemetery in 1923. However, the cemetery is indicated in 1946 U.S.G.S. topographic maps and on the current maps.

An interview with Mr. Earl Hamilton of the Penal Institutions Department, and a former Superintendent of the Suffolk County House of Corrections at Deer Island, provided additional evidence concerning the new northeast cemetery (personal interview, 1987). According to Mr. Hamilton, the new northeast cemetery is also called Resthaven, or new Resthaven. He was unsure as to how long it remained in use, but suggested that it was likely that bodies were buried there until the road was built connecting Deer Island with Winthrop after the U.S. Army Corps of Engineers filled Shirley Gut in 1933/1934.

Current practice on the island with regard to deceased prisoners is to call a Boston mortuary to pick up the body. Following an autopsy, the death is logged in the prison death book and the body is either turned over to relatives or, if unclaimed, is buried in a City pauper cemetery such as Mt. Hope Cemetery (Hamilton, personal interview, 1987).

In 1970, when Mr. Hamilton began working at Deer Island, the new northeast cemetery or new Resthaven was marked by some 30 to 40 white wooden crosses in poor repair. A photograph in Mr. Hamilton's possession, roughly dated to 1929, shows the cemetery in the upper center as a large area stretching between the piggery to the boundary wall and tightly filled with white wooden crosses (Figure 6.1.8-2). Judging by this photo it appears likely that indeed all 4,160 bodies from old Resthaven had been transferred and reinterred in the new Resthaven cemetery above the Hill Prison Building. In addition, Mr. Hamilton knew of no reason to believe that these bodies had been removed from the island since the picture was taken. Sometime prior to the 1970's, the practice of sending details of prisoners to paint the crosses and maintain the cemetery had ceased. The condition of the cemetery had been allowed to deteriorate until it was barely acknowledgeable as a cemetery in 1985.

The primary goal in this research has been to discover as much information as possible relating to the new cemetery noted in the 1985 archaeological reconnaissance survey and located on the northeast slope behind the Hill Prison building. Three hypotheses concerning this cemetery were developed and tested using the data collected.

Hypothesis I concerned the possibility that the new northeast cemetery contained only bodies of inmates of the House of Correction who had died since the closing of old Resthaven Cemetery, after the sale of the southern portion of Deer Island to the U.S. military. In this case, few bodies would be expected: only those bodies unclaimed between 1907-1908 and the present.

Hypothesis II was similar to the first hypothesis, but indicated that the eighteen bodies buried in the old cemetery on the island during or since the sale to the U.S. Government may have been reinterred in the new cemetery along with unclaimed bodies buried in the years since the property transfer.

Hypothesis III suggested that, upon the sale of the southern portion of Deer Island, all 4,160

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FIGURE 6.1.8-2
1929 DEER ISLAND PHOTOGRAPH
SHOWING NEW RESTHAVEN CEMETERY
UPPER CENTER

city interments in old Resthaven were removed to the new cemetery, closer to the prison facilities. This hypothesis also took into account the probability that subsequent bodies may have been added.

During the course of the in-depth documentary research, contradictory evidence was uncovered concerning the origins and development of the new northeast cemetery. No data was recovered which supported Hypothesis I. The only mentions made of the new cemetery also referred to reinterments. Evidence collected from the U.S. Army Corps of Engineers documents tended to support Hypothesis II, suggesting that 18 bodies had been transferred from old Resthaven Cemetery and reinterred in the new northeast cemetery. City documents, though containing little information pertaining to burials, indicated that "all the bodies in the old cemetery" were reinterred in the new plot (City Doc. 29, 1909:8).

It now appears most likely that Hypothesis III is correct, that the cemetery in question is "New Resthaven Cemetery" created in 1908 with the reinterment of some 4,160 bodies from old Resthaven Cemetery in the military reservation on the southern portion of Deer Island. The cemetery, at its present location, is 79 years old, or greater than 50 years in age, which requires additional archaeological investigations in accordance with NHPA. In addition, 2,559 of the bodies reinterred in new Resthaven are 100 years in age or older, many of them having been quarantine hospital victims and Irish immigrants. Additional unclaimed bodies were probably buried in the plot at least through the early 1930's when Shirley Gut was finally filled and Deer Island was connected by road to Winthrop.

What this research has revealed is that the new northeast cemetery plot, or new Resthaven, is much larger than expected from the cursory field inspection of the site. Judging by the photo, the cemetery extended from the northeast wall of the old piggery to the cement boundary and wall, and from the sea wall at the top of the slope to the mausoleum at the foot of the slope. The many wood scraps originally thought to be picket fence remains and, therefore, assumed to be markers of the plot's boundary, were more likely remnants of the wooden crosses which were once maintained to mark the graves in the tightly packed cemetery.

As no evidence has been found suggesting the removal of these burials to another location, it is expected that some 4,160 to 4,500 bodies remain interred in the new cemetery. The only evidence for the plan of burials within the new cemetery is the 1949 photo. It suggests that either individual graves were located very close together or that individual crosses marked bodies buried in trenches. The latter possibility seems most probable for the reinterments due to the age and likely condition of the earlier burials when transferred from old Resthaven Cemetery, where evidence indicates the bodies were buried eight to ten per trench.

The results of additional archaeological testing, currently underway, will be included in the final report. Two methods of remote sensing techniques, soil resistivity and electron magnetometry, will be used to attempt to discern any patterns of disturbance that may be present in the area of the historic period cemetery and that could possibly signify burials. Experience with soil resistivity testing at several historic period cemeteries ranging in age

from the late seventeenth to nineteenth centuries has indicated that more recent burials have greater resistivity. A soil resistivity survey of the Deer Island cemetery may be an effective way to identify the probable location of burials prior to any actual subsurface testing. Electron magnetometry works in a similar manner and will act as a second verification method. The end results of the soil resistivity and electron magnetometry surveys will include, in conjunction with the Massachusetts Historical Commission, a map or plan of the location of soil anomalies. This map will then be used to plan an effective subsurface testing or burial verification program for the cemetery, if necessary.

The primary objectives or tasks for the recommended fieldwork would include: (1) determination of the horizontal extent of the cemetery through systematic subsurface testing; and (2) collection of sufficient data to reconstruct the internal configuration or plan of the cemetery and general mode of burial (individual graves, multiple burials in trench, etc.) used at this site.

Actual subsurface testing, within the known cemetery, to verify the existence of burials will involve the use of both machine assisted and hand excavation techniques. A small backhoe or similar machine will be used to excavate a series of narrow trenches through the cemetery to expose the upper surface of filled grave shafts. Machine excavated trenches could be oriented in several ways within the cemetery area. Subsurface anomalies located by soil resistivity testing that represent potential unmarked burials could be tested with judgmentally oriented trenches placed on the locations of these anomalies. Other deliberately placed trenches will be necessary to identify the horizontal limits of the cemetery if it is found to actually contain unmarked burials. Given the moderately sloping surface of the cemetery, the machine excavated trenches will probably have to be oriented perpendicular to the natural slope, since it would be unlikely that a backhoe or similar equipment could operate across this slope. These trenches will be excavated with machinery (small backhoe or front-end loader) only to a depth sufficient to identify a filled grave/burial shaft. Once a definitive grave shaft or fill has been identified, hand excavation will be used to complete the investigation. Excavation with hand tools would proceed only until the presence of human skeletal remains can be verified within an identified grave or burial. Once human skeletal remains have been positively identified they will be left in situ and the State Archaeologist will be notified.

Representative soil profiles will be recorded from all machine excavated trenches and scaled drawings made of profiles exposed during the excavation of specific burials. The locations of trenches excavated during the archaeological investigation and any burials identified during the survey will also be mapped. All aspects of the archaeological investigation will be recorded in documentary photographs (color, black/white). This would include photographing any burials located and positively identified during fieldwork.

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6.2 REGULATORY CONSIDERATIONS

The design of wastewater treatment facilities for Boston Harbor and the Massachusetts Bay area must be responsive to, among other things, the requirements of federal and state statutes governing water quality. Key among these are the federal "Clean Water Act" (P. L. 92-500, as amended): the federal "Marine Protection, Research and Sanctuaries Act" (P. L. 92-532, as amended, commonly referred to as the "Ocean Dumping Act"); the "Massachusetts Clean Waters Act" (ALM GL c21 ss 26-53); the federal "National Environmental Policy Act" (NEPA) and its corresponding state statute, the "Massachusetts Environmental Policy Act" (MEPA).

In some aspects, the federal law supersedes state law; and in others, it gives states primacy, although usually only where state requirements and/or authorities -- particularly those related to enforcement -- equal or exceed those in the federal statutes. Collectively, these laws comprise a framework of environmental goals and objectives, regulatory mechanisms and standards, and administrative schedules and deadlines. Individually, they affect varying aspects of the proposed project in ways ranging from the level of treatment to the timing of the actual construction and operation of the final facilities.

The following paragraphs provide an overview of the pertinent features of each of these and several related statutes.

6.2.1 THE FEDERAL CLEAN WATER ACT

In 1972, Congress responded to the growing public concern about the quality of the Nation's surface waters and overrode a Presidential veto to enact one of the most far-reaching and aggressive environmental regulatory statutes in the history of the country. In place of what some perceived as an ineffectual, almost casual process for addressing water quality problems, there was now a detailed comprehensive national program for abating water pollution.

The Federal Water Pollution Control Act Amendments of 1972, P. L. 92-500, (now referred to as the "Clean Water Act") established goals, targeted objectives, and set deadlines for cleaning up municipal and industrial sources of water pollution. The "old law's" system of cumbersome enforcement conferences and highly subjective procedures for determining whether a polluter was "contravening" water quality were replaced with a system of permits containing specific clean-up standards and detailed schedules for reporting on the progress of clean-up efforts. The new law also raised the stakes for polluters: For violators of the statute's requirements, there would be sizeable daily fines; and for those who would do so willfully, jail sentences.

In short, the new federal water quality law brought about a wholesale change with respect to the issue of water quality, launching the Nation on a massive clean-up effort that would seek "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters".

Goals and Policies

The 1972 Act set forth two milestones to guide those who would carry out the law. The first,

often referred to as the statute's "zero discharge" clause, established as a national goal "that the discharge of pollutants into the navigable waters be eliminated by 1985." The second, commonly called the "fishable/swimmable" requirement, established as an interim goal that "wherever attainable...water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983."

In fashioning this legislation, Congress also set forth several significant policies, three of which are of particular importance to the Boston Harbor project: a prohibition on the "discharge of toxic pollutants in toxic amounts"; the provision of "Federal financial assistance" to help municipalities construct the wastewater treatment systems that would be needed to comply with the law's clean-up requirements, and an "areawide waste treatment management planning (program)... to assure adequate control of sources of pollutants in each State..."

Perhaps the most significant and fundamental change of all, however, was the decision to use technology based performance standards to determine just how much cleaning up individual polluters would have to do.

<u>The Shift From Water Quality To Technology Based Requirements</u>

Prior to the 1972 law, the determination of just how much treatment a city or industry would have to apply to its wastewater discharge was determined by relying on professional judgments about how much pollution a stream, estuary, or other receiving water could absorb without harm: its so-called "assimilative capacity". All too often, this water quality based approach failed to be effective. The reasons for this are well stated in a 1980 report by the U.S. House of Representatives' Committee on Public Works and Transportation:

> In the simpler program prior to 1972, treatment requirements were based primarily on a determination of what was necessary to meet a desired set of conditions in a water body. State water pollution control agencies assigned uses to each stream, such as fishing, swimming, water supply and industrial use. Subject to acceptance by the public, the most sensitive use for each stream was then defined by a set of "criteria" which became the operative "water quality standards".
>
> Water quality standards proved to be deficient in too many respects to be considered a reliable basis for determining treatment requirements. Criteria for many parameters, such as heavy metals, oil and grease, and nutrients, were often vague, in some instances consisting of little more than narrative statements limiting their presence "in any harmful amount". Even when there were specific numbers, such as for pH, suspended solids or coliform bacteria, they were often stated in widely varying ranges depending on the water body in question and a particular state's law and policies.
>
> The scientific tools, particularly the mathematical models for translating water quality standards into specific pollution control limitations, also were a stumbling block. Focusing on only a few parameters and relying heavily on numerous assumptions (often

because of lack of data), these models tended to compound the weaknesses and ambiguities of the water quality standards themselves.

Generally the water quality based approach allowed polluters to delay clean-up of their wastewater discharges. Cities and industries alike argued that it was not theirs, but someone else's discharge that was actually causing the receiving water's assimilative capacity to be exceeded. Even in cases where it was patently obvious as to whose sewer pipe was causing the problem. regulators were often impeded by endless debates over how to determine a stream or estuary's real assimilative capacity, the actual amount of clean-up that was necessary to abate the problem. or what constituted a "harmful amount" of one or more pollutants. It became one expert's judgment against the other's, and while debates raged on and arguments poured forth, so too did billions of gallons of pollution.

Technology Based Effluent Limitations

Consequently, when Congress began to fashion the 1972 amendments to the Water Pollution Control Act, it elected to relegate the highly subjective water quality based approach to a secondary role, relying instead on standards that would be based on the performance of cleanup technologies. Simply stated, if an existing treatment technology was capable of consistently removing a certain amount of pollution, that removal capability would become the standard, or "effluent limitation". The level of technology, and the time frame in which the new limits would have to be achieved, were set by law so as to move the country forward towards the law's goals and objectives on an incremental basis.

Municipal Clean-Up Requirements and Deadlines

The 1972 Federal Water Pollution Control Act Amendments established a cleanup program that was designed to have municipalities achieve the new 1983 "fishable/swimmable" interim goal in two steps over a 10 year period. The first step, to be accomplished by July 1, 1977, was for every community to provide at least secondary treatment of their wastewater, a level of treatment capable of removing about 85 percent of the pollutants in typical domestic sewage.[1]

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[1] The statute actually left the technical definition of effluent limits for secondary treatment to the EPA Administrator. After much debate, the EPA finally published rules defining secondary treatment as that level of treatment which would limit the discharge of biochemical oxygen demanding substances (BOD)) and suspended solids (SS) to no more than 30 parts per million (ppm) each, on a monthly average basis. The definition also required that to qualify as secondary treatment, the installed technology must also be capable of removing 85 percent of the SS and BOD entering the treatment works even if it meant that the resulting concentrations would be more stringent that the "30-30" standard. Consequently, the definition of secondary treatment actually requires varying levels of performance in different situations. However, in all cases, the specific requirements are based on the ability of various types of treatment technologies to provide what is known as "biological" treatment, and consequently, the technology based performance requirement of the law was effectively adhered to in this definition.

The second step, to be achieved by July 1, 1983, was for each community to install a more stringent level of control, based on effluent limitations reflecting "the best practicable waste treatment technology over the life of the works...", "BPT" as it is commonly called. This performance standard, however, never was defined in a precise way.[2] Its very nature, and its location in the statute -- buried in a section of the law defining how communities were to go about the task of planning for needed treatment plants -- allowed it to be ignored (Congress repealed this provision in 1983.)

Water Quality Based Standards and Advanced Waste Treatment

Congress continued to be concerned that even these two levels of effluent control might prove inadequate. Consequently, the 1972 Act included additional provisions to ensure that water quality goals would be achieved.

First, it continued the old system of EPA approved state water quality standards. Second, it required, under Section 301(b)(1)(C) of the law, that dischargers achieve "any more stringent limitation, including those necessary to meet water quality standards..." by 1977. Third, in order to overcome the inherent deficiencies of water quality based approaches to regulation, the new statute authorized the EPA to set effluent limits in areas where "...in the judgment of the Administrator, discharges of pollutants from a point source or group of point sources, with the application of effluent limitations...would interfere with the attainment of (the 1983 goal)." Fourth and finally, the law also required that a "total maximum daily (pollutant) load...be established at a level necessary to implement the applicable water quality standards with seasonal variations and a <u>margin of safety which takes into account any lack of knowledge</u> concerning the relationship between effluent limitations and water quality." (Emphasis added).

In short, these provisions authorize the EPA to set more stringent <u>water quality based effluent standards</u> and apply them without debate, argument, or delay. Further, in those cases where not enough is known to translate a stream's assimilative capacity into an "end-of-pipe" cleanup requirement, the law allows the EPA to almost arbitrarily tighten the prescribed effluent limitations just to make sure that the job gets done.

The net effect of this water quality based effluent standards provision has been to virtually force hundreds of communities to provide treatment well beyond conventional secondary treatment levels. Congressional concern about the cost-effectiveness of these projects -- they often doubled a project's costs, yet produced little or no measurable improvement in water quality -- resulted in their being subjected to more stringent controls and review procedures prior to approval. This has since limited the number of communities that have had to apply advanced waste treatment (AWT), or at least limit how much more treatment would be necessary. However, the requirements are still in the law, and they continue to be used, especially in areas where too little is known about what may actually be causing a pollution problem.

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[2] As a practical matter, BPT for municipalities was simply assumed to be equal to secondary treatment.

Toxic Chemical Limitations and Industrial Pretreatment

In framing the requirements of the 1972 clean water law, Congress also attempted to address yet another, rather specific water pollution issue: the need to regulate chemical discharges, particularly those from industries that used public sewer systems to dispose of their wastes -- so-called "indirect dischargers". Many of these chemicals such as PCBs, DDT, Aldrin, dieldrin, and toxaphene, are highly toxic, capable of upsetting and rendering useless the biological treatment technologies used by municipalities to treat domestic wastewater flows. Others were not only toxic, but resistant to treatment altogether, and likely to pass right through a municipal plant, ending up in the rivers, harbors, streams and estuaries from which they were supposed to be banned.

The importance of regulating toxic chemical discharges was underscored by the growing realization that, once in the water, many of these substances accumulated in the food chain, posing health risks to people. They were also found to be causes of various mutagenic, carcinogenic and teratogenic effects in certain fish and shellfish species. In short, they were dangerous to both humans and the environment.

Consequently, when the 1972 Act was established, it prescribed as a national policy that "the discharge of toxic pollutants in toxic amounts be prohibited". To carry out this policy, the law authorized the EPA Administrator to establish a list of toxic compounds and an effluent standard -- including complete prohibition where warranted -- for each chemical on the list. Once established, industries that discharged their effluents directly to surface waters would have to comply with the standard or prohibition within a specified time frame, or be subject to penalties.

With respect to the indirect discharger problem, Congress went a step further; it required the EPA to issue "regulations establishing <u>pretreatment</u> <u>standards</u> for introduction of pollutants into treatment works which are publicly owned for those pollutants which are determined not to be susceptible to treatment or which would interfere with the operation of such treatment works". (Emphasis added). Industries were given three years to comply with a standard, once issued.

The "NPDES" Permit Program

To tie the statute's several components together -- the effluent limitations, pretreatment requirements, deadlines and goals, etc. -- Congress established a "National Pollutant Discharge Elimination System" (NPDES) Permit Program as part of the 1972 Act. The previously cited House Committee Report provides some insight and perspective to the thinking and rationale behind this provision: .

> The NPDES Permit Program is the primary regulatory mechanism for accomplishing the law's objectives. This is the mechanism for applying the BAT, pretreatment and other requirements of the law to individual discharges...It was seen ideally as a straightforward approach to ensuring that all of the Nation's dischargers would know just what they were to

accomplish, when it had to be done, and what the penalties for failure would be. A piece of paper, a permit issued by U.S. EPA or by the State, theoretically was to tell it all, succinctly and clearly ...

> ... every wastewater discharger in the Nation was to be issued a permit containing specific limitations on the amount of pollutants, including chemicals, that could be discharged.... If the quality of discharged wastewater did not meet the permit requirements, violators could be fined up to $25,000 a day and sentenced to up to one year of prison (with doubled penalties for repeated violations).

In recognition of both the enormity of the task and the fact that several states had similar programs already in place, the law authorized the EPA to delegate the responsibility for carrying out the day-to-day details of the NPDES Permit program to qualified states. (Massachusetts has not received full delegation of this authority.) However, by law, the EPA remains accountable and responsible for enforcing the law's requirements.

Permits, once issued, last for five years. This allows each permit to be updated and revised periodically as new standards or limitations are established, or old ones tightened to reflect advances in cleanup technology. Theoretically, any discharger without a permit after December 31, 1973, was subject to suit, as were those who failed to comply with the terms of permits that were issued.

The law also included a provision authorizing citizens to sue polluters who violated their permits, and/or the EPA Administrator if he/she failed to carry out specific provisions of the law. This "Citizen's Suit" provision also provides for the award of court costs to plaintiffs when warranted.

The Municipal Construction Grants Program

When Congress enacted the 1972 Federal Water Pollution Control Act Amendments, it recognized that the higher levels of cleanup imposed by the new statute would require the expenditure of massive amounts of capital. Congress also recognized that many communities, be they large or small, would not be able to bear the financial burden of constructing the facilities needed to comply with the new law. Nor would many communities move on their own to comply with such costly Federal rules without Federal funding.

In short, if the Federal government was going to expect communities to respond to Federal water pollution control and abatement requirements, then the Federal government was going to have to help foot the bill. Accordingly, Congress included in the law an authorization of $18 billion for grants to communities for 75 percent of the costs of planning, designing, and constructing the mandated wastewater treatment plants and sewage collection systems.

In making these grants, the EPA administrator was required by statute to encourage waste treatment management systems or facilities that would recycle pollutants, reclaim wastewater, make use of waste products and waste heat, and if possible, provide for "open space" and other "recreational considerations".

The law also required that the grant applicant demonstrate prior to the award of a grant that "alternative waste management techniques have been studied and evaluated" and that a sewer collection system "discharging into such treatment works is not subject to excessive infiltration". Grant applicants were also required to show that the proposed facility was part of a larger, area-wide waste treatment management plan (called for by yet another section of the law) and that the project would be "in conformity with any applicable State plan" under yet another, broader, state-wide water quality planning requirement.

Grant applicants were also required to guarantee their payment of the "non-Federal costs" of the project, and ensure that the completed facility would be properly operated and maintained. To be eligible for a grant, projects were also to include a "sufficient reserve capacity for future growth, and a system of "user charges to assure that each recipient of waste treatment services within the applicant's jurisdiction...will pay its proportionate share...of the costs..."

Procedurally the Construction Grants Program followed a three step process. "Step 1" involved the development of a facilities plan, or feasibility study. It was at this level that many of the treatment alternatives and other statutory prerequisites and issues were addressed for later review and approval by federal and state officials.

Upon completion and approval of the Step 1 Facilities Plan, a community would then apply for a "Step 2" grant to help pay for the next phase of the project, namely the development of design specifications and cost estimates. When these were completed and approved, a final application was made for a "Step 3" construction grant. On award of this last grant, the community could proceed to bid and construct the project.

Amendments To The Clean Water Act

Since its enactment in 1972, there have been three major sets of amendments to this law. The first of these was enacted in December 1977. Formally titled the "Clean Water Act" -- the name by which the entire law is now generally referred to -- this bill made a number of "mid-course corrections", several of which simply reflected the fact that it was going to take a lot longer and a lot more money to accomplish the law's original objectives. Among the major changes and/or additions made by the 1977 bill were:

- Authorization of an additional $20 billion to continue the Construction Grants Program through fiscal year 1982, a reflection of the fact that a more accurate assessment of what it would cost to meet the municipal cleanup goals had raised the original estimate of $24 billion to well over $100 billion.

- The authorization of 10 percent bonus grants to communities that used "innovative or alternative" waste treatment technologies, authorizing a total federal grant of 85 percent in such cases.

- Projects to treat discharges from separate stormwater drainage systems -- a $67 billion "needs" category -- were eliminated from eligibility for Construction Grants.

and collector sewer projects were given a lower priority.

- o State agencies were given the authority to administer the day-to-day functions of the federal Construction Grants Program for the EPA. Two percent of the annual allotment of federal construction funds was authorized to be set aside for use by states to cover the cost of carrying out this new role. However, EPA retained ultimate authority over many critical aspects of the program.

- o The municipal secondary treatment deadline of July 1. 1977 was extended to July 1, 1983 for those communities that could not meet an earlier date, or in those cases where the federal government could not provide authorized (Construction Grants Program) financial assistance.

- o Municipalities discharging into marine waters were authorized to apply for waivers from the secondary treatment standard. Included in the amendment were extensive provisions detailing the criteria that would have to be met before such a waiver might be granted.

- o The municipal waste water treatment "user charge" provision was modified to allow the use of the less precise. but widely used ad valorem tax to collect these charges.

- o The industrial pretreatment standards requirements were modified to allow industries to be given "credits" for the pollutant removal capability of the POTWs to which they sent their effluents. This amendment was to help industries avoid the costs of having to install what was believed to be redundant treatment capabilities.

- o EPA was also required. as part of a major revamping of the industrial effluent limitations requirements of the law. to establish new industrial effluent limits and pretreatment standards for 129 specified toxic compounds.

In December of 1981, a second set of major amendments to the Clean Water Act was signed into law. For the most part, these amendments focused on scaling back the federal commitment to funding a share of the costs of constructing municipal wastewater treatment plants. After 10 years, few projects had been completed under this program, despite the expenditure of more than $30 billion of federal Construction Grant funds, and support for this costly program began to wane.

The shift in federal policy for funding municipal water pollution abatement efforts also reflected the growing pressures on Congress to control spending and cut the federal deficit. As a result of these and other concerns, the 1981 amendments to the Act included provisions that:

- o Limited eligibility for federal Construction Grants to treatment plants. interceptors. and major cost items. such as pumping stations and outfalls. and infiltration/inflow repairs.

- Allowed only up to 20 percent of a state's annual Construction Grants Program allocation to be set aside to address combined storm-sanitary sewer overflow (CSO) problems, and only if requested by a state's Governor.

- Beginning in fiscal year 1985, reduced the federal share of eligible project costs from 75 percent to 55 percent, and restricted the funding of a project's reserve capacity to that amount needed to serve the population existing at the time of the grant award.

- Authorized another $9.6 billion to continue the Construction Grants Program through fiscal 1985.

- Eliminated grant funding for Step 1 facilities plans and Step 2 design projects, until the Step 3 construction phase grant is awarded. At that time, a grantee can receive an "allowance" for the costs of the Step 1 and 2 work. However, there is no guarantee that the amount would equal what would have been paid if these items had been left as statutorily grant eligible.

- Redefined secondary treatment for oxidation ponds, lagoons and ditches, and trickling filters, forms of biological secondary treatment that had been limited from use in most instances because of the way the EPA initially, and rather narrowly, defined secondary treatment.

- Extended the deadline for achieving the municipal cleanup standard of secondary treatment for the second time, from July 1, 1983 to July 1, 1988, for those communities that could not complete construction by the 1983 deadline, or that could not obtain federal financial assistance.

The third and most recent set of amendments to the federal statute were enacted in February 1987. The amendments again focused heavily on the Construction Grants Program. In this instance, the 1981 change in federal fiscal policy was taken a step further with the bill completely phasing out the Construction Grants Program at the end of fiscal year 1990. The 1987 Act also authorized:

- $75 million in funds for grants to state water pollution control agencies to assist in the cost of administering state water pollution control regulatory programs.

- Approval of municipal wastewater treatment plant user charge systems that allow low income users to pay lower fees for sewer service.

- Authority for up to 1 percent of the annual Construction Grants Program allotment to be set aside, during fiscal years 1987 and 1988 for addressing water quality problems in marine bays and estuaries caused by combined stormwater and sanitary sewer (CSO) discharges from nearby urban areas. The amount set aside is reduced to one-half percent for fiscal years 1989 and 1990.

- An additional $9.6 billion in funds for the remaining years of the Construction Grants Program.

- An additional $10.2 billion in funds for the newly created State Revolving Loan Fund Programs, to be used as seed money to create an alternative vehicle to help communities finance treatment projects after the demise of the Construction Grants Program.

- Requirements for states to begin assessing their waters to identify toxic hot spots; that is, areas where very stringent water quality based effluent standards may have to be imposed to remedy chemical pollution problems.

- The issuance of permits containing more stringent standards for controlling the disposal or other disposition of wastewater treatment plant sludges.

6.2.2 THE "MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT"

The federal "Marine Protection, Research, and Sanctuaries Act of 1972" (MPRSA), often referred to as the "Ocean Dumping Act," after a 1977 amendment, established a National policy that "the dumping of all types of materials into ocean waters" be regulated, and that "the dumping into ocean waters of any material which would adversely affect human health, welfare . . . or the marine environment, ecological systems . . . " be prevented, or at least strictly limited.

By definition, Congress included within the law's jurisdiction the regulation of sewage sludges that would be dumped into the ocean, thereby reinforcing the sludge disposal restrictions of Sec. 405 of the Clean Water Act.

<u>Ban On Dumping</u>

In November 1977, Congress amended this law to tighten the statute's provisions concerning the disposal of sewage treatment plant sludges and industrial wastes. Section (4) of the amendments (P.L. 95-153) stipulated that the dumping of such substances was to stop by 1981:

> The Administrator of the Environmental Protection Agency...shall end the dumping of sewage sludge and industrial waste into ocean waters...as soon as possible...but...in no case may the Administrator issue any permit...which authorizes any such dumping after December 31, 1981.

<u>Ocean Dumping Permits</u>

Section 102(a) of the Act requires that the dumping of sewage sludge and other materials into ocean waters be subject to the issuance of a permit by the U.S. Environmental Protection Agency (EPA). Before issuing an ocean dumping permit, however, EPA must determine that the "dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment..."

Ocean Dumping Permit Evaluation Criteria

Section 102(a) also requires the EPA to establish a specific set of criteria with which to evaluate ocean dumping permit applications. In developing the review criteria, the law requires the EPA to take into consideration a number of factors with which to assess effects of the proposed dumping on:

- o Human health
- o Fisheries and other aquatic resources, and on wildlife, shore lines and beaches
- o Marine ecosystems (including their biological, physical and chemical processes, changes in diversity, productivity and stability, and species and community population dynamics)
- o The persistence and permanence of the effects of the proposed dumping

In addition, the law requires that the EPA consider whether adequate consideration has been given to evaluating alternatives that might better address the intent of the statute. Specifically, the Act requires EPA to give consideration to: "Appropriate locations and methods of disposal or recycling, including land-based alternatives and the probable impact of requiring use of such alternate locations or methods upon considerations affecting the public interest".

The law also stipulates that "no permit may be issued for a dumping of material that will violate applicable water quality standards," and that to the extent possible, the activities authorized by a permit should be required to conform to the "standards and criteria" of the International Ocean Dumping Convention.

Section 102(c) of the Act authorizes the EPA Administrator to designate certain sites and times that can be used for dumping activities. The Administrator is also empowered to take a more selective and detailed approach for regulating ocean dumping. Specifically, this section of the Law authorizes the Administrator to restrict the dumping of specific substances at specified sites, thus allowing certain things to be dumped at a particular waste site, but not others.

Permit Conditions and Penalties

The MPRSA requires that wastewater treatment authorities and others seeking to dump wastes in the ocean submit an application for a permit and "provide such information as [the Administrator] may consider necessary to review and evaluate such application." The statute also requires that permits specify (a) the type and amount of material to be dumped; (b) where and for how long the dumping will occur; and (c) any other special provisions, restrictions, etc., that are deemed appropriate.

Permittees that violate the statutes' requirements, or the conditions of a permit, are subject

to fines of up to $50,000 a day for each day of violation. For those who do so "knowingly", prison sentences of up to one year may be added to the fines.

The law also gives the EPA Administrator the authority to revoke or suspend a permit when its conditions have been violated. Further, the Act gives citizens the right to sue violators, and EPA, if the latter is not carrying out the law.

6.2.3 THE NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Polciy Act (NEPA) is one of the shortest, but perhaps most significant environmental statutes. Enacted by Congress in 1969, NEPA established that:

> ...it is the continuing policy of the Federal Government...to use all practicable means and measures...to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social economic, and other requirements of present and future generations...

NEPA also established that:

> ...it is the continuing responsibility of the Federal Government to use all practicable means...to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may...attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.

As a means of carrying out this policy, the Congress established that <u>all</u> Federal agencies, prior to commencing any "major Federal actions signficantly affecting the quality of the human environment", prepare an "Environmental Impact Statement" (EIS) which could then be used to assess the extent to which the proposed action, or project, would comply with the law's policies. Included in such "actions" were grants for such things as constructing wastewater treatment plants. Specifically, the EIS was to identify the probable environmental impact of the proposed project, along with a detailed analysis of:

- o Unavoidable adverse environmental effects
- o Alternative methods for accomplishing the project
- o The short vs. long term benefits and/or trade-offs
- o Irreversible effects and/or irretrievable commitments of resources that would result

The 1969 legislation also established a National Council on Environmental Quality. The Council, pursuant to the law, and the President's Executive Order (E.O 11514), is responsible for:

- o Assisting the President in monitoring and reporting on trends in the environment

- o Developing recommendations to the President of national environmental policies
- o Overseeing Federal agency execution of NEPA requirements. and
- o The resolution of conflicts between Agencies due to the requirements of the law

6.2.4 THE MASSACHUSETTS CLEAN WATERS ACT

Sections 26 through 53 of Chapter 21 of the General Laws of Massachusetts comprise the Commonwealth's "Clean Waters Act." Included in these sections of the State's laws are the several requirements and authorities for regulating the discharge of pollutants into the Commonwealth's inland and coastal waters. and for providing assistance to communities for the construction of sewage treatment plants.

The Division of Water Pollution Control

The law vests overall responsibility for preventing. controlling. and abating water pollution in a Division of Water Pollution Control (DWPC). The Division. which functions as part of the state's Department of Environmental Quality Engineering. is charged with encouraging local communities to develop and carry out comprehensive "plans for the prevention. control and abatement of water quality". It is also responsible for preparing comprehensive river basin and regional water pollution abatement plans with which actions taken under other sections of the law must comply.

The State's MCWA also calls for the Division to. among other things:

- o Adopt minimum water quality standards:
- o Regulate the discharge of pollutants through a statewide permit program;
- o Prescribe effluent limitations for both municipal and industrial sources of pollutants that can be applied through the permit program;
- o Make grants to local governments for the planning. design. and construction of wastewater treatment plants and collection systems: and
- o Adopt and enforce regulations for the proper operation and maintenance of both industrial and municipal wastewater treatment plants.

Enforcement Powers

The Massachusetts Clean Waters Act authorizes the Division of Water Pollution Control to investigate and inspect sources of water pollution. and to require discharges to apply for. and comply with the terms of wastewater discharge permits. The law also make it illegal for anyone to discharge any pollutant into the state's waters "except in conformity with a permit."

Discharges who willfully and knowingly violate the law are subject to fines of up to $25,000 a day, per day of violation, and up to one year in prison. For unintentional violations, dischargers are subject to a maximum fine of up to $10,000 per day of violation.

6.2.5 THE MASSACHUSETTS ENVIRONMENTAL POLICY ACT

The requirements for assessing the impacts of construction and other project-related activity on the environment within the Commonwealth are contained in Section 61 through 62H of Chapter 30 of the General Laws of Massachusetts. Known as the Massachusetts Environmental Policy Act (MEPA), these sections of the law require that any undertaking by private parties and/or government agencies be subjected to a careful review, and that appropriate measures be taken to protect the state's natural resources.

Section 61 of the law requires that all state agencies, in carrying out their responsibilities, "review, evaluate, and determine the impact on the natural environment" of these various projects, including capital intensive public works. The statute further requires state agencies to "use all practicable means and measures to minimize damage to the environment," and to take "all feasible measures" to prevent water pollution, damage to marine resources and seashore areas, and other adverse environmental impacts.

The law imposes identical requirements on private developers of projects as well, particularly those seeking permits and/or grants.

Environmental Impact Reports

The statute requires that all public and private project proposals be submitted to the State's Secretary of Environmental Affairs to determine the need for an Environmental Impact Report (EIR). In those cases where it is determined that an EIR is required, the Secretary is responsible for identifying those issues and the scope of the concerns that must subsequently be addressed.

Following this determination of need, the party responsible for the project must then proceed to develop a comprehensive assessment of the project, and its impact on the environment. The developer (or government agency) must also identify "all measures being utilized to minimize environmental damage; any adverse . . . consequences which cannot be avoided; and reasonable alternatives to the proposed project and their environmental consequences". Once completed, the EIR is widely circulated among government agencies and the public, and subjected to a formal public notice and review process, prior to the granting of any funds or permits.

Once the final EIR is filed and made available, government agencies are required to act on any pending permits or applications for grants. Generally, permits are issued, or grants made for those projects that, where certain actions are required by the EIR, a permit or grant may be "conditioned" to ensure that the appropriate project modification, or environmental impact mitigation measures are carried out.

Section 62 G of MEPA allows a project applicant to substitute draft and final environmental

impact statements being filed with federal officials under the Federal NEPA statute for those required by State Law.

Challenges to Environmental Impact Reports

The State Law also provides a procedure for challenging both the decision to require/waive the preparation of an EIR, and the adequacy of a final EIR. In both cases, the complainant must file notice of his/her intent to take issue with the decision or report within sixty days of the issuance of a notice that the decision has been made, or that the report has been filed.

For projects involving financial assistance grants or permits to a private project, the challenge must be initiated by a) 30 days after the grant or permit is issued, or b) within 60 days of the notice that the decision on the need for the EIR has been made, or the EIR itself has been filed. Similar rules apply for public projects.

6.2.6 OTHER FEDERAL AND STATE STATUTES

There are also several other Federal and State laws that have some direct or indirect bearing on the proposed facility improvements. These include the Federal Rivers and Harbors Act of 1899, as amended; the Federal Coastal Zone Management Act of 1972, as amended; and the Massachusetts Coastal Zone Management Act. In the following sections, a brief description of the germane provisions of these laws is provided.

The Rivers and Harbors Act

The Federal Rivers and Harbors Act of 1899 requires that the building of any wharfs, piers or other structures, or any excavating or filling of navigable waters of the United States is subject to review and approval by the Secretary of the Army. Consequently, many of the water/shore related construction activities contemplated in the proposed facilities plan will require Army Corps of Engineers' permits.

The Federal Coastal Zone Management Act

The Federal Coastal Zone Management Act of 1972, P.L. 92-583, was enacted to encourage states to develop and implement programs for improving the management of the land and water resources in their respective coastal zones. As an incentive, the law provides for grants to State Coastal Zone Management (CZM) agencies, so long as those agencies comply with the various Federal policies, objectives and criteria.

Pursuant to the terms of this statute, State CZM agencies are eligible for grants if they provide for, among other things:

- The protection of natural resources within the coastal zone;
- The management of coastal development to minimize such things as the destruction of beaches, dunes, wetlands and barrier islands;

- o Public access to the coasts for recreation purposes;
- o Assistance in the redevelopment of deteriorating urban waterfronts and ports; and
- o Assistance to support comprehensive planning and management for such things as the siting of pollution control and other facilities in the coastal zone.

The Massachusetts Coastal Zone Management Program

In 1983, the Massachusetts legislature enacted a bill that established within the State's Executive Office of Environmental Affairs a Coastal Zone Management Office. Pursuant to the terms of the bill, the CZM Office was charged with the purpose of securing "for the inhabitants of the Commonwealth the objectives and benefits of the Federal Coastal Zone Management Act..." discussed in the prior section.

As an approved Coastal Zone Management agency under the Federal Law, the Massachusetts CZM is authorized to review all Federal actions that can affect the land and water resources of the coastal zone for their consistency with various Federal Environmental Coastal Zone policies. This includes any action wherein a Federal Grant or permit will be issued, particularly those that authorize or otherwise facilitate construction within the zone. Permits or grants for projects that do not comply, including those for wastewater treatment plants, can be denied.

The CZM office's " Federal Consistency Review" seeks to ensure that projects conform to the State's Coastal Zone Management priorities. Of particular significance to the proposed projects are those policies established to ensure that:

- o Complexes of marine resource areas of unique productivity are protected;
- o The attainment of national water quality goals is supported, including the application of State and Federal effluent limitations;
- o The adverse effects of dredging and the disposal of dredged materials are minimized with respect to water quality, marine productivity and the public's health; and that
- o State and Federal requirements governing sub-surface waste discharges and sources of air and water pollution and the integrity of inland wetlands are met.

6.3 APPLICABLE WATER QUALITY CRITERIA AND STANDARDS

6.3.1 MASSACHUSETTS WATER QUALITY STANDARDS

The waters of the outer harbor area have been classified by the Massachusetts Division of Water Pollution Control (MDWPC) as Class SA waters. SA waters are designated for the uses of protection and propagation of fish, other aquatic life, and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration (purification) in approved areas.

Table 6.3.1-1 lists the minimum criteria for all waters and the additional criteria for Class SA waters.

6.3.2 EPA WATER QUALITY CRITERIA

As the water pollution control effort in the United States progresses, and the traditionally considered pollutants become sufficiently treated to protect water quality, attention is turning towards pollutants that impact water quality through toxic effects. EPA has, over the past decade, issued several editions of compendia of water quality criteria, and in 1984, a "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants" (EPA, 1984).

In support of this policy, EPA published a "Technical Support Document for Water Quality-Based Toxic Control" in 1985, which presented recommendations to regulatory authorities to be used when those authorities are faced with the task of controlling the discharge of toxic pollutants to the nation's waters. The document provides guidance for each step in the water quality-based toxics control process, from screening to compliance monitoring. It also details the current water quality criteria recommended by EPA, and how these criteria might be applied.

Toxics are regulated in two ways: through whole-effluent toxicity testing, and through constituent-by-constituent analyses. Whole-effluent toxicity testing is performed to assess the combined effects of effluent toxics on aquatic life. Certain aquatic organisms are exposed to varying dilutions of the effluent and two concentrations are determined: the LC50, the concentration at which 50 percent of the organisms die; and the No Observable Effect Limit (NOEL): the dilution for which there appears to be no effect on the growth of the representative species.

Constituent-by-constituent analyses consider the individual impacts of toxicants on aquatic life. Since aquatic impacts are a function not only of magnitude, but also of duration and frequency with which criteria are exceeded, EPA's recommended aquatic life criteria, for both individual toxicants and whole-effluent toxicity, are specified as two numbers: the Criteria Continuous Concentration (CCC), for protection against chronic effects; and the Criteria Maximum Concentration (CMC), for protection against acute effects.

TABLE 6.3.1-1

COMMONWEALTH OF MASSACHUSETTS
WATER QUALITY STANDARDS

Minimum Criteria

The following minimum criteria are adopted and shall be applicable to all waters of the Commonwealth, unless criteria specified for individual classes are more stringent.

Parameter	Criteria
1. Aesthetics	All waters shall be free from pollutants in concentrations or combinations that: a) Settle to form objectionable deposits; b) Float as debris, scum, or other matter to form nuisances; c) Produce objectionable odor, color, taste, or turbidity; or d) Result in the dominance of nuisance species.
2. Radioactive Substances	Shall not exceed the recommended limits of the United States Environmental Protection Agency's National Drinking Water Regulations.
3. Tainting Substances	Shall not be in concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms.
4. Color, Turbidity, Total Suspended Solids	Shall not be in concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms.
5. Oil and Grease	The water surface shall be free from floating oils, grease and petrochemicals, and any concentrations or combinations in the water column or sediments that are aesthetically objectional, objectionable or deleterious to the biota are prohibited. For oil and grease of petroleum origin the maximum allowable discharge concentration is 15 mg/l.
6. Nutrients	Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.

7. Other Constituents	Water shall be free from pollutants alone or in combinations that: a) Exceed the recommended limits on the most sensitive receiving water use; b) Injure, are toxic to, or produce adverse physiological or behavioral responses in humans or aquatic life; or c) Exceed site-specific safe exposure levels determined by bioassay using sensitive resident species.

Additional Criteria

The following additional minimum criteria are applicable to coastal and marine waters for Class SA waters.

Parameter	Criteria
1. Dissolved Oxygen	Shall be a minimum of 6.0 mg/l.
2. Temperature	None except where the increase will not exceed the recommended limits on the most sensitive water use.
3. pH	Shall be in the range of 6.5-8.5 standard units and not more than 0.2 units outside of the naturally occurring range.
4. Total Coliform Bacteria	Shall not exceed a median value of 70 MPN per 100 ml and not more than 10% of the samples shall exceed 230 MPN per 100 ml in any monthly sampling period.

The CCC for a particular pollutant is the four-day average concentration not to be exceeded more than once in three years. The CMC, ideally, is the one-hour concentration not to be exceeded more than once in three years. However, EPA recognizes that for most discharges it is impractical to expect samples to be taken more frequently than once a day. Therefore, in effect, CMC becomes a concentration not to be exceeded by the highest daily value in three years.

These criteria are to be applied to waters immediately outside an established zone of initial dilution (ZID). EPA regulations further dictate how and where within the ZID the CMC is to be met.

In addition to aquatic life criteria, EPA has also issued two human health criteria. The toxic human health criterion addresses the danger toxic chemicals pose to the functioning of specific organ systems, such as the liver, heart, kidney, and brain. The carcinogenic human health criterion addresses the danger to genetic material, resulting in cancer and/or genetic mutations. The established standards represent a 10^{-5}, 10^{-6}, and 10^{-7} potential increase in cancer risk due to lifetime exposure. While the aquatic life criteria have clearly defined dose, exposure, and frequency restrictions, the human health criteria provide dose restrictions only. Exposure and frequency restrictions for the human health criteria are based on a 70 kg male eating 6.5 grams of fish or shellfish per day and drinking two liters of water per day for a period of 70 years. The criteria may be considered more stringent when applied to marine waters than when applied to fresh waters, in that while fish or shellfish may be consumed directly by human beings, the seawater will not.

EPA-recommended values of CCC and CMC and human health criteria for a variety of toxicants have been published most recently in 1986 in the "Gold Book" (Quality Criteria for Water, EPA, 1986). Table 6.3.2-1 shows "Gold Book" CMC and CCC human health criteria for pollutants detected in MWRA influent.

The Massachusetts Division of Water Pollution Control is currently drafting a state-wide water toxics program that is expected to be adopted by the end of 1987. DWPC issued a guidance letter to the Authority, dated May 15, 1987, to facilitate MWRA's facilities planning efforts that require completion prior to the proposed adoption. The letter admonishes that the interim guidance does not include the requirements of the 1987 Amendments to the Clean Water Act--specifically, the requirement that the states must adopt water quality standards with numerical criteria for a list of priority pollutants.

The DWPC guidance letter directed the Authority to use both specific numerical criteria and whole effluent testing in assessing compliance with water quality standards. The letter recommended that the EPA "Gold Book" Criteria be used to assess compliance with specific numerical limits. The DWPC further recommended that MWRA use a 10-6 risk factor for the protection of public health, although the Authority may consider using a 10-5 factor in certain circumstances. The letter noted that should a site not comply with the guidance criteria because of the proximity of another discharge, DWPC would develop a wasteload allocation.

TABLE 6.3.2-1

EPA-RECOMMENDED POLLUTION CONCENTRATION GUIDELINES
FOR PRIORITY POLLUTANTS DETECTED IN MWRA EFFLUENT

	Aquatic Life		Human Health	
	CMC	CCC	Toxic	Carcinogenic
Priority Pollutant	(ug/l)	(ug/l)	(ug/l)	(ug/l)
Chloroform	-	-	-	15.7
Chromium	1100	50	3,433,000	-
Copper	2.9	-	-	-
Dichloroethane, 1,2-	-	-	-	243
Ethylbenzene	430	-	3280	-
Ethylhexylphthalate	-	-	50,000	-
Lead	140	5.6	-	-
Mercury	2.1	0.025	0.146	-
Methylene Chloride	-	-	-	15.7
Nickel	140	7.1	100	-
Silver	2.3	-	-	-
Tetrachloroethylene	-	450	-	8.85
Tetrachloroethylene, 1,1,2,2-	-	450	-	8.85
Trichloroethane, 1,1,1-	-	-	-	1.03
Trichloroethylene	-	-	-	80.7
Zinc	170	58	-	-

6.4 HARBOR PERSPECTIVE

The mandate of the harbor perspective task has been to probe and stimulate conceptual planning -- and establish a context -- for the detailed evaluation and design of treatment facilities to be constructed by the Massachusetts Water Resources Authority (MWRA) at the Deer Island and Nut Island project sites. The scale of the proposed secondary treatment plan will significantly transform Deer Island, influencing the image and quality of the northern gateway to Boston Harbor as well as the environs of the adjoining community of Winthrop. At the Nut Island site the challenge is to abandon the existing plant and construct a headworks facility in a manner unique to its pivotal gateway context between Quincy Bay and Hingham Bay. Together these project sites will help define the character of the Harbor for 50 years or more. The project theme, "Planning for a Century," thus exemplifies the foundation of the macroscale planning that is documented in this section and in Section 7.1 of Volume VI, Site Preparation.

6.4.1 BACKGROUND DEFINITION

To establish the framework for identifying and evaluating alternative concepts for these two project sites, a definition of the pertinent background issues within which conceptual planning must take place is provided. The background issues include:

- Current land use around Boston Harbor showing the peninsula context of the project sites and the residential character of the abutting communities.

- Existing geographical and environmental conditions indicating that the project sites are subject to tidally influenced storm surges and require designs that respond to a 100-year high flood level of 117 ft. MDC Sewer Datum (MDCSD) on Deer Island, and 122 ft, MDCSD on Nut Island.

- A visual analysis of Boston Harbor that is structured upon a three-part study: (1) visual elements of the harbor that show the gateway context of both project sites; (2) image layering that establishes the points of intervisibility between abutting communities and the project sites: and (3) image profiles of the project sites that highlight the visual importance of the post-glacial drumlin formations to the project sites and to the collective memory of Boston Harbor.

- The MWRA's program to mitigate the impacts of the proposed plant on its neighbors was also reviewed. Six categories of potential impacts upon abutting communities have beenidentified: visual, traffic, noise, odor, property values, and safety.

- The master plan for Boston Harbor Island State Park, prepared by the Department of Environmental Management (DEM), has projected a dramatic increase in harbor island usage within the next 10 years. Since both project sites fall within the park boundaries, the themes that guide the DEM master plan have influenced planning for the project sites. The DEM's themes include: designing with natural forces: harbor geography: harbor transportation: and harbor history.

- o Design criteria have been developed for conceptual treatment process layouts at both project sites. The conceptual plant layouts utilized are refinements of the layouts presented in the siting (FEIR) reports. Subsequent memoranda will deal with detailed engineering analysis and process layouts. The design criteria at this conceptual phase of the study consist of site zoning, treatment process area needs, preliminary site grading, site security, and traffic.

- o The analysis of the constraints and opportunities summarizes three primary groups of salient issues identified in the background definition phase. They are the social, technical, and environmental considerations.

6.4.2 ALTERNATIVE CONCEPTS

Section 8.6 of Volume III will discuss and document alternative concepts identified for the project sites and the evaluation process of each. From a broad ranged formulation of land use ideas that reviewed a range of alternatives, four concepts were developed for Deer Island and two concepts for Nut Island.

Engineering needs at Deer Island require that all of the island be available to construct the new plant and to provide a buffer zone to that plant. The plant's construction will require that much of the existing treatment plant be substantially modified or abandoned. The plant's size also requires that the area presently occupied by the prison complex be available for construction of the new plant.

Of the four alternatives selected for evaluation at Deer Island, two alternatives, I and II, are based upon concepts that make the new secondary treatment plant a prominent feature of the harbor; two other alternatives, III and IV, minimize the visual prominence of the plant. In this respect, Alternatives I and IV represent the polar ends of a spectrum of alternatives. Alternative I entirely removes the drumlins from the site by creating a flat, level condition and exposing the view of the plant to the harbor. Alternative IV retains the excavations from the drumlins and creates a perimeter ring of undulating and landscaped landforms that hide the plant from view. Alternative I offers the largest available area for treatment facilities and construction, and greatest flexibility in designing the treatment process; Alternative IV is the most constrained and offers the least flexibility in designing the treatment process. Alternatives II and III are variants between Alternatives I and IV.

Engineering needs on Nut Island require the eventual removal of the existing treatment plant which occupies most of the site, and its replacement by a smaller headworks facility located somewhere on the existing site. Three optional locations on the site are presented for discussion. The locations for headworks are limited due to the constraints of the site and the need to maintain operation of the existing treatment plant during construction. The continual operation of the facilities under some of these locations would require that interim facilities for portions of the existing plant be provided. The feasibility of these headworks sites, the required coordination with other studies, and a detailed engineering evaluation of the maintenance of plant operation under each of the options will be the subject of subsequent phases of this project. The site also accommodates an MWRA pier facility and provides service

access to the headworks and pier. Otherwise the remaining site can be dedicated to open/passive recreation.

Alternative site planning concepts of Nut Island were developed for discussion purposes only. using a site toward the end of the island. The two concepts are variations of the same basic theme. but differ mainly in the level of active recreation and extent of public access proposed. The desirable and acceptable levels of activities and access will be a part of future discussion with the appropriate review agencies including the adjacent communities.

Table 6.4.2-1 is a summary table of the information presented herein for the four Deer Island concepts and the two Nut Island concepts. The information is summarized by social. technical. and environmental factors.

6.4.3 NEXT STEPS

In summary. the harbor perspective task has defined the broad context of Boston Harbor within which the specific planning and design studies for the project sites should occur. It has developed conceptual. macroscale plans for the treatment facilities in text. two dimensional plans. CADD imagery. and three-dimensional models. It has evaluated their visual and contextual impacts on a preliminary and limited basis. The documentation is now firmly set for a defined and measurable means of receiving comments from the MWRA. other agencies. and the public. Subsequent phases of the facilities plan will address the issues of facilities engineering. costs. and financial effects. jurisdictional implications. judicial concerns. and institutional/implementability issues. The concepts presented herein are considered as a beginning point for the detailed site evaluations. The reader should not assume that the final site layouts will be exactly as indicated in any of the options shown herein. The final plan is expected to be a blend of the visual analysis herein. public comment. and the detailed evaluation of engineering needs. Based upon the concept images and tools of study established in this task. the next steps -- facilities engineering. site planning. and development of architectural concepts for the project sites -- may proceed with a defined sense of direction and certainty.

HARBOR PERSPECTIVE SUMMARY TABLE

	ALTERNATIVE CONCEPTS FOR THE DEER ISLAND SITE				ALTERNATIVE CONCEPTS FOR THE NUT ISLAND SITE	
FACTORS	Number I THE LEVEL CONCEPT	Number II THE SINGLE MOUND CONCEPT	Number III THE NECKLACE CONCEPT	Number IV THE RING CONCEPT	Number I PASSIVE PUBLIC RE-USAGE	Number II ACTIVE PUBLIC RE-USAGE
SOCIAL						
Visual appearance	Facility to become a prominent feature seen by both Winthrop and Boston	Facility to become a prominent feature seen by Boston. Site shield from Winthrop view.	Shielded from Winthrop Boston view mixed drumlin shapes and plant images	View of plant shielded Site appears as a natural drumlin	Existing plant gone Headworks shielded from view	Existing plant gone Headworks shielded from view
Recreational potential	Maximum level area for active reacreation fields	Opportunity for level areas for active usage	Limited level/active zones, trails and passive use possible	Limited level/active zones, trails and passive use possible	Area of existing plant generally available forested for passive use	Area exst plnt genrly available, develop active usage, possible public dock
Scenic potential	Drumlin image lost No high vantage point overlooking harbor	Drumlin shape partially preserved. Limited vantage points.	Favorable views from drumlins and of outer slopes of drumlins	Favorable views from drumlins and of outer slopes of drumlins	Water level views	Water level views
TECHNICAL						
Main process area	Optimum process area	Reasonable process area	Limited process area	Limited process area	Roughly 2 acres somewhere on site	Roughly 2 acres somewhere on site
Process layout opportunity	Unconstrained site, additional available area process layout bounded by shore boundaries	Minimum constraint, additional area available if needed process layouts can extend to shore	Constrained area, limited additional level areas for process alternates or revisions	Constrained area, no additional level areas for process alternates or revisions	Maintaining current plant during constructn limits site opportunities	Maintaining current plant during constructn limits site opportunities
New drumlin(s)	No new drumlins	One new drumlin at northeast end of isle	Drumlins on NE shore from Winthrop to tip, also portion of SW shore	Drumlins on NE shore from Winthrop to tip, also on the SW shore	Possible low profile buffer - drumlin	Possible low profile buffer - drumlin
Off-site movement of surplus excavation	Excess excavation approx 3 million cyd	Excess excavation approx 2 million cyd	Excess excavation approx 1 million cyd	limited excess excavation maximum on-site reuse	Buffer construction and filling of plant will require on-site movement of fill material	Buffer construction and filling of plant will require on-site movement of fill material
ENVIRONMENTAL						
Protection from wind	Open site exposed to wind	Wind buffer in northeast portion of isle only	Site protected from wind	Site protected from wind	Open site exposed to wind presently - transformed by buffer landform	Open site exposed to wind presently - transformed by buffer landform
Buffer zone vegetation	Few protected niches revegetation likely to be limited by exposure	Reasonable at drumlin, limited in open areas	Reasonable sites for revegatation	Reasonable sites for revegatation	Proposed revegetation of site	Proposed revegetation of site

6.4.4 BOSTON HARBOR CONTEXT - EXISTING CONDITIONS

Existing Land Use Plan

The land use plan of the areas surrounding Boston Harbor (shown on Figure 6.4.4-1) indicates the context within which Deer Island and Nut Island are situated. Residential, commercial, industrial, transportation, open/institutional, water recreation, participant/spectator recreation areas, and the Boston Harbor Islands State Park boundaries have been shown. This information is based upon documents provided by the Metropolitan Area Planning Council and the Department of Environmental Management.

An analysis of the abutting areas to Deer Island shows the primarily residential nature of the Town of Winthrop to the northeast, the transportation character of Logan International Airport to the west, the open/institutional character of Long Island and the main shipping channel of President Roads to the south, with Broad Sound and the Atlantic Ocean to the north and east.

Nut Island is abutted to the south by the residential areas of Hough's Neck in Quincy, to the northeast by the open areas of Peddock Island, and to the west and east by the Bays of Quincy and Hingham, respectively.

While working within the engineering constraints of the treatment facilities design, the future physical planning of Deer and Nut Island should be cognizant of the existing adjacent uses by minimizing any negative impacts to the affected residential neighborhoods, while maximizing the recreation and scenic potential of the MWRA project areas in a manner consistent with mitigation commitments.

Environmental Conditions Plan

The natural environmental conditions that must be either protected against, highlighted, or recreated, as well as the man made environmental conditions that effect the site, have been identified to establish a baseline for the formation and evaluation of concepts.

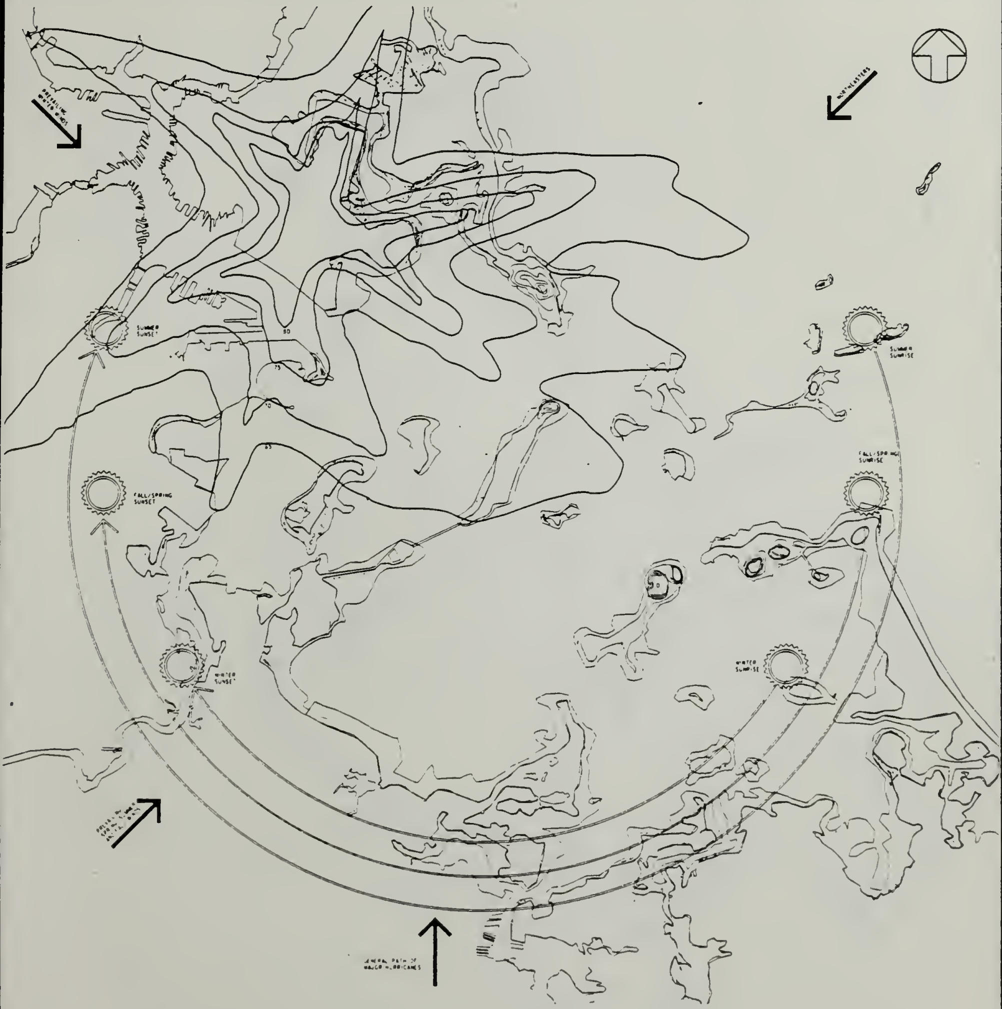
The environmental conditions that impact the alternative planning concepts include sun, wind, noise, geography, water, and tide characteristics.

Environmental conditions diagrams, shown on Figure 6.4.4-2 and 6.4.4-3 document:

- Sun paths for all seasons.
- Prevailing wind directions and direction of major storms, the "northeasters."
- Existing noise sources and patterns produced by Logan International Airport.
- Existing drumlins and harbor topography.
- Water depths and major areas of tide and wave action.

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.4.4-1
EXISTING LAND USE



Legend

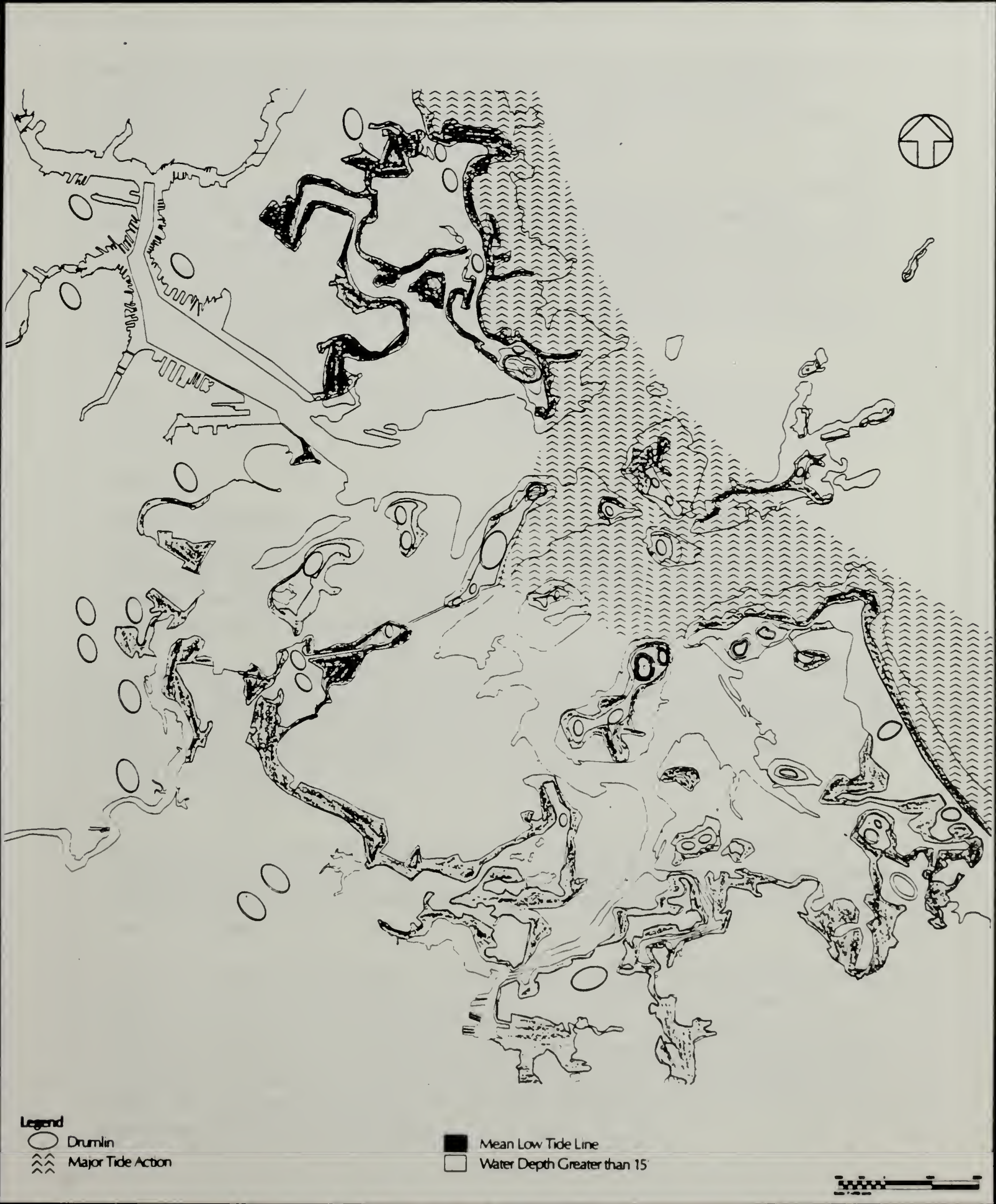
Noise Pattern

Mean Low Tide Line

65 LDN Noise Levels

MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.4.4-2
EXISTING ENVIRONMENTAL CONDITIONS I



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.4.4-3
EXISTING ENVIRONMENTAL CONDITIONS II

Successful planning schemes should effectively use existing environmental conditions through creative planning concepts and landscaping to beneficially direct prevailing breezes; block objectionable winter winds, noise, and tide action; take advantage of sunny locations; and be cognizant of the natural character of the Boston Harbor islands.

The post-glacial formations, known as drumlins, which occur frequently in the Boston Harbor region and specifically on Deer Island, offer a unique geological feature of distinction. These hillock forms of compacted till have served as important promontories in the history of Boston, with Bunker Hill seen as one of the better drumlins. Early images of the harbor indicate that in the time of the American Revolution, there had been approximately three drumlins on Deer Island and possibly one on Nut Island, but these have since been radically transformed or eliminated.

Finally, of great significance is the anticipated flood level, which for Deer Island is 117 ft MDCSD (1.4 ft above the record flood tide, 115.6 MDCSD) and 122 ft MDCSD for Nut Island.

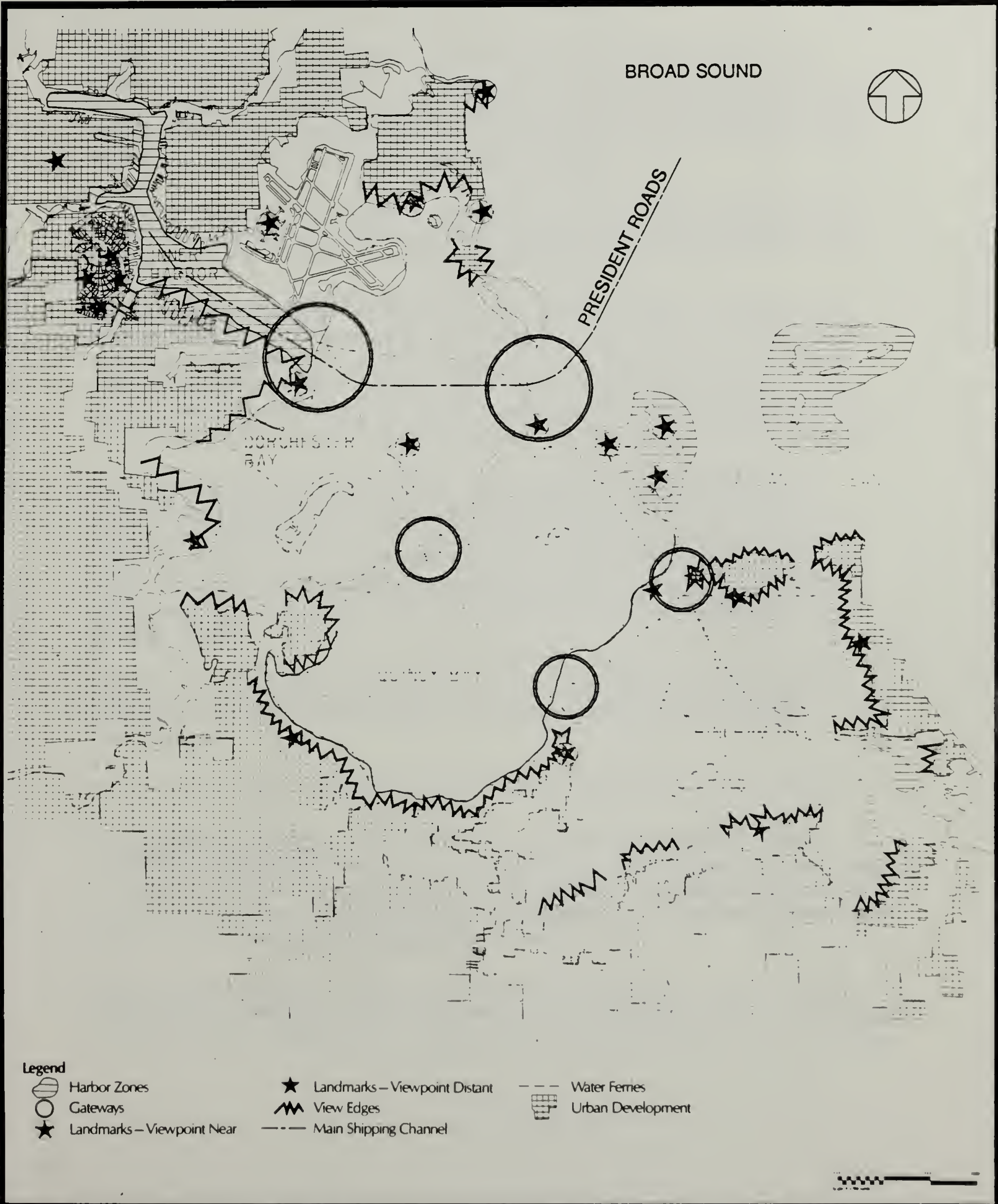
Visual Analysis

To develop the concepts for the visual appearance of the site, to establish the contextual image of the site, and to determine the compatability of the sites image with adjacent uses, it is necessary to analyze the visual elements of the site's surroundings--the harbor and adjacent communities--and to identify those locations from which the site is seen and will be seen, and to identify the image or profile that is seen.

The visual analysis of Boston Harbor carried out by Jung/Brannen Associates, Inc. was inspired by the inceptional research on the image of Boston undertaken by the late Professor Kevin Lynch of M.I.T. in The Image of the City. Additionally, the master plan report of the Boston Harbor Islands State Park and field investigations confirmed the conceptual basis of the analysis. A three-part study on the harbor considered the following aspects: visual elements, image layering, and image profiles.

Visual Elements - The analytical components that constitute the primary visual elements of Boston Harbor are considered to be the harbor zones, gateways, landmarks, view edges, paths (main shipping channels, water ferries, and air routes), and the zones of urban developments, as shown on Figure 6.4.4-4.

The harbor is composed of six zones -- the inner harbor, Dorchester Bay, Quincy Bay, Hingham Bay and two clusters of islands: Gallop, Lovells, George's Island and the Brewsters. Two major gateways and three minor gateways are evident. Deer Island and Long Island frame the major Atlantic gateway to the outer harbor, while Logan International Airport and Castle Island frame the second major gateway between the inner and outer harbor. Nut and Peddock Islands create a minor gateway between Quincy Bay and Hingham Bay. The other two minor gateways do not impact either of the MWRA project areas.



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 6.4.4-4
VISUAL ANALYSIS

Landmarks are key visual elements that create focal points for viewing the harbor by their vertical and horizontal prominence. A prominent vertical landmark is the Bunker Hill monument, while an example of a horizontal landmark is the Wollaston Yacht Club. With regard to Deer Island and Nut Island, a distinction was made between landmarks that provided a near view and those that provided only a distant view of the islands in question.

Complementing the landmarks study is a study of the view edges to the outer harbor from the surrounding zones of urban development. These view edges are extensive and primarily linear, relating to low and medium density residential developments around the harbor.

Image Layering - Deer Island - Based upon the identification of landmarks established in the previous section on visual elements, zones of vision to Deer Island were drawn from the near and distant viewpoint landmarks as shown on Figure 6.4.4-5. Near views to Deer Island are obtained from various places in Winthrop, Logan Airport, Castle Island, and the islands to the south. Distant views are available from the office towers of downtown Boston and Back Bay, the JFK Library in Dorchester, from the shores of Nahant, and from the point at Hull High School.

A composite of view cones creates an image layering diagram that shows clearly that the prominent, perceived zones of Deer Island are its northwest and southwest shorelines. A corollary study identified areas of intervisibility. These are areas from which one can clearly see the site and which, in turn, can be clearly seen from the site. Around Deer Island areas of intervisibility (such as Point Shirley, Winthrop, and Long Island) should be viewed as an integral part of any future design and planning studies by virtue of their visual relationship with Deer Island.

From the water, three types of craft have views of the site: shipping in the main channels; ferry service that follows designated routes; and recreational craft that will view the site from several points.

In addition to the land and water based viewpoints, the air vantage point was also considered.

Image Profiles - Deer Island - Elevations of the four major shoreline silhouettes of Deer Island were drawn (as shown on Figure 6.4.4-6) and analyzed. The analysis showed the emphasis of the central drumlin, which rises about 100 ft above water level; the cupola of Hill Prison; the smoke stack of the old pumping station; stone embankments; and the shoreline zones that are situated to the east, south and western edges of the island.

Image Layering - Nut Island - Consistent with the analysis of Deer Island, cones of vision to Nut Island were drawn from the near and distant viewpoint landmarks in Quincy Bay and Hingham Bay and are shown on Figure 6.4.4-7. The near view came primarily from the Quincy Great Hill

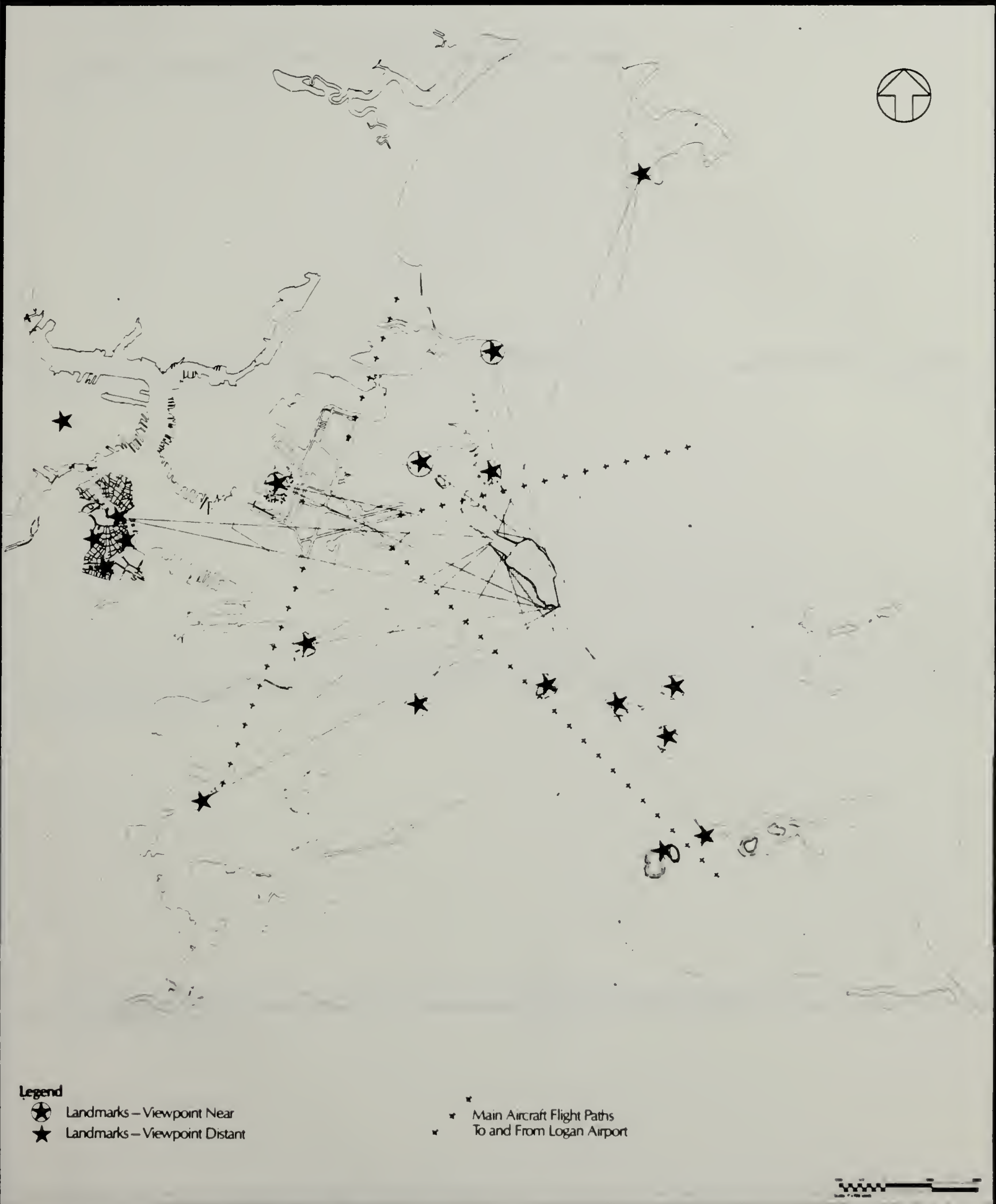


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FIGURE 6.4.4-5
DEER ISLAND
IMAGE LAYERING

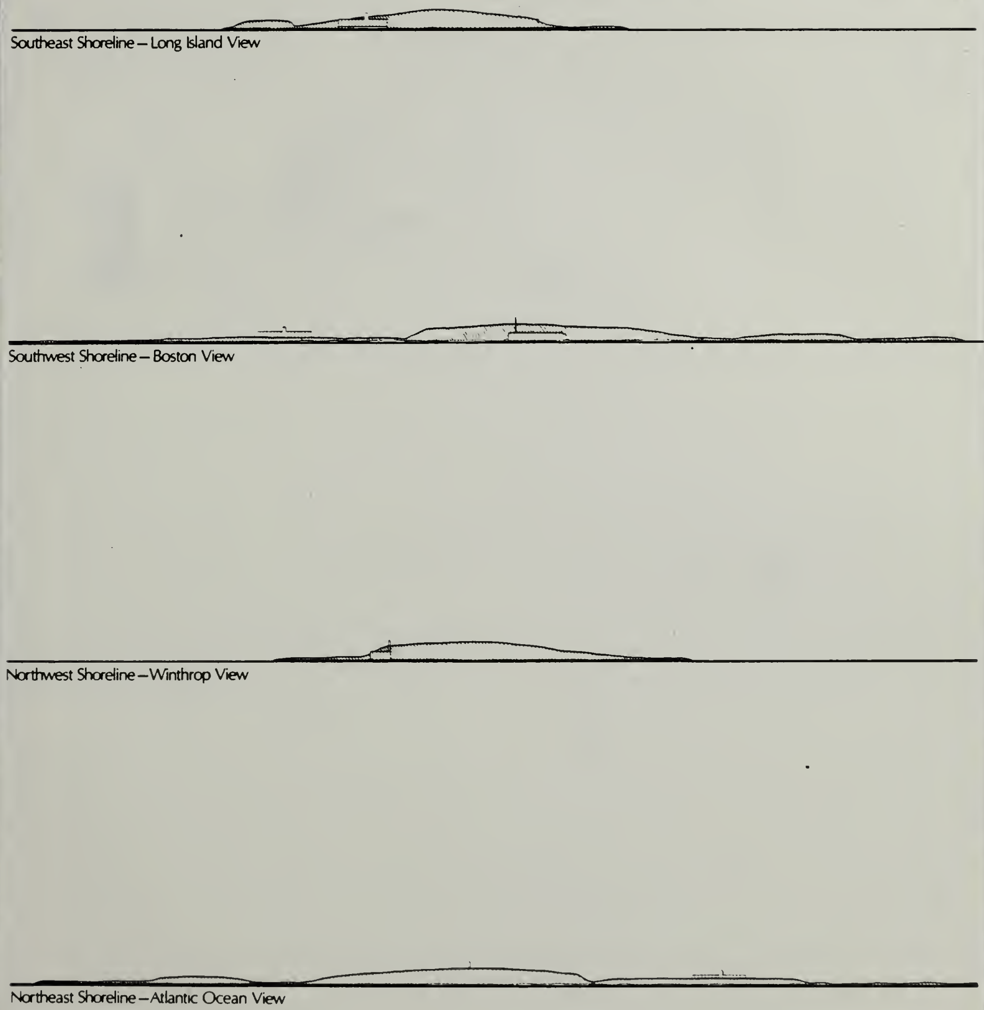

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FIGURE 6.4.4-6
DEER ISLAND
IMAGE PROFILES

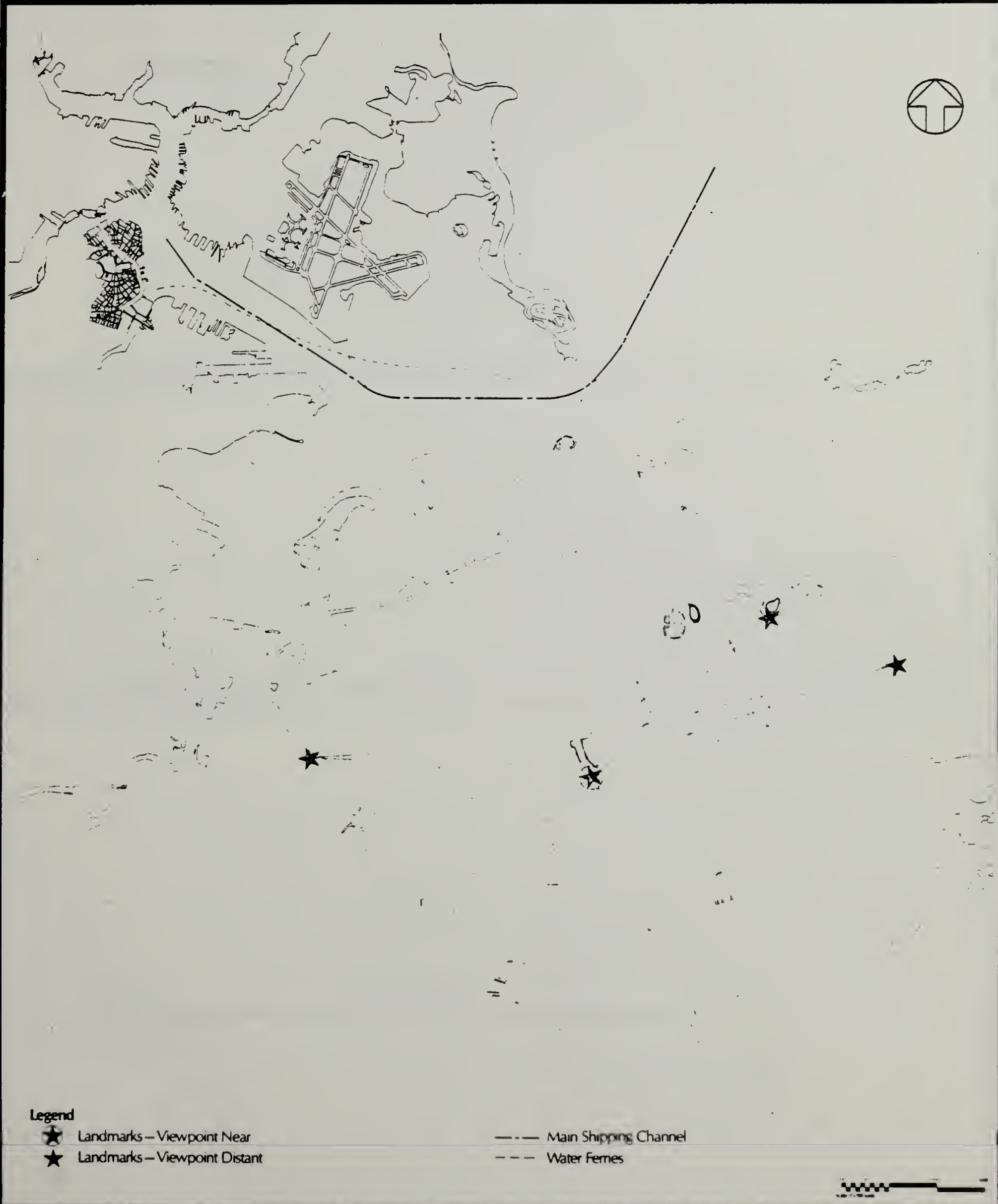

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FIGURE 6.4.4-7
NUT ISLAND
IMAGE LAYERING

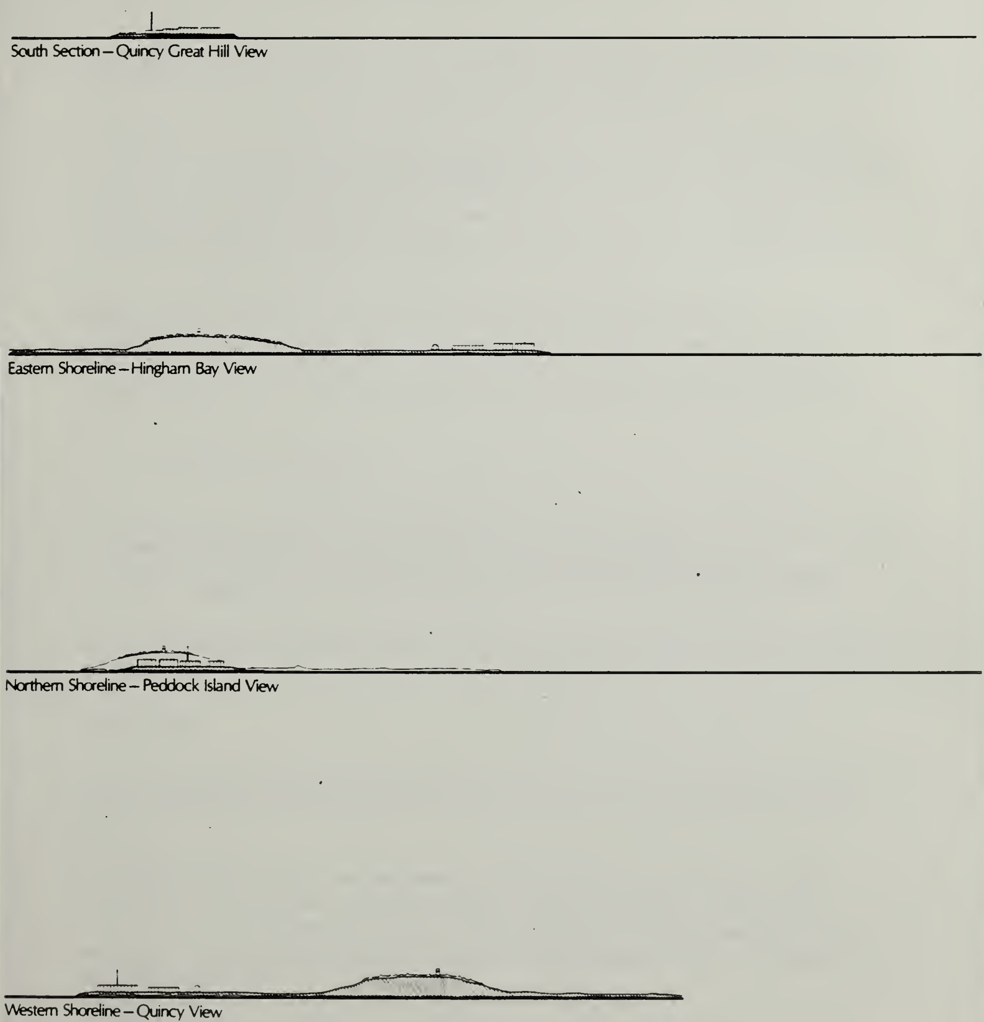

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FIGURE 6.4.4-8
NUT ISLAND
IMAGE PROFILES

in Hough's Neck: the distant views are available from the Wollaston Yacht Club and beaches. and in Hull from both the old Steamboat Wharf. and The Boston Yacht Club.

A composite of views creating an image layering diagram was drawn for Nut Island. but it is clear that the near views from Quincy Great Hill and the northern shore of Hough's Neck are the predominant near image of major concern. The latter also create the areas of intervisibility that should receive the greatest future design attention. Of course. the northern shoreline of Nut Island will be clearly seen from the water by ferryboat riders and pleasure craft. and this should be considered in the planning process.

Image Profiles - Nut Island - The four major elevations of Nut Island were drawn. as shown on Figure 6.4.4-8. and analyzed. The analysis showed the rather flat. elevated nature of the man-made landform that characterizes much of this peninsula today. The strong rip-rap image. the smoke stack of the treatment plant. and the dominant shape of Quincy Great Hill are the visual characteristics of note.

6.4.5 MITIGATION PROGRAMS

The MWRA has identified effects of the proposed plant and as appropriate has made a commitment to mitigate effects of the facility on its neighbors. Six categories of effects were identified: traffic impacts. noise impacts. odor impacts. visual impacts. impacts on property value. and impacts on safety.

Briefly. the MWRA's mitigation commitment and the corresponding macroscale planning criteria are as follows:

Traffic Impacts

The MWRA has committed to barging almost all construction related traffic during development. and has committed to busing construction workers and evaluating the practicality of ferrying workers.

Construction Traffic Impact - Planning concepts minimizing the need for extensive on-and off-site movement of materials and spoils will have a significant advantage. Plan for the development of harbor docking piers to be used for the barging of materials brought to the site and removal of excess materials and spoils. and ferrying of construction works if determined to be a feasible alternative.

Operational Traffic Impact - Plan on using harbor docking piers to barge chemicals and other materials used in plant operation so as to minimize traffic through adjacent communities.

Noise Impacts

The MWRA has committed to complying with noise control standards and has established as a goal acceptable noise levels that are lower than legally required.

Planning concepts that create buffer zones to contain noise within the plant and/or shield adjacent communities will have significant advantages.

Odor Impacts

The MWRA has committed to constructing a plant with a limit of no detectable odor off-site.

Planning concepts that define zones for the noxious elements of the plant to be located at maximum distances from receptor populations will have an advantage.

Visual Impacts

While the MWRA's formal commitment does not call for specific visual standards, the Authority has committed planning resources for careful definition of development alternatives and is committed to meaningful participation by the public in selection of a final site planning alternative to mitigate visual impact.

It is apparent that macroscale planning can define the visual impact of the plant by either minimizing the visual impact of the plant's development, or conversely, by making the new plant a prominent harbor feature of visual interest.

Impacts On Property Value

Planning level goals are to preserve or improve property values by creating maximum opportunities for multi-use and passive recreational activities for the impacted communities. Planning level work assumes that the Deer Island House of Correction has been relocated off Deer Island, thus creating maximum land for the facilities and allowing an opportunity for multi-use and recreational activities near Winthrop.

Impacts On Safety

Planning level concepts have considered the positive advantages of isolating the plant from pedestrians and non-plant personnel. Safety also includes minimizing the need for through traffic in adjacent communities.

6.4.6 BOSTON HARBOR ISLANDS COMPREHENSIVE PLAN

Both Deer Island and Nut Island fall within the official boundaries of the Boston Harbor Islands State Park. The master plan for Boston Harbor Islands State Park projects a dramatic increase in park usage within the next 10 years due to improvement in public and private inter-island transportation, island support facilities, and public awareness of the park's

accessibility. Although no specific recreational or other uses have been designated for Nut and Deer islands under the Master Plan, they can also contribute to this expected flourishing of the harbor by incorporating the goals and themes of the Master Plan into the layout of the treatment plant sites.

The basic goal of the master plan is to make the harbor islands experience available to more of the Commonwealth's residents while preserving the islands' fragile and subtle qualities that make the experience worthwhile.

There are four themes that guide the harbor islands master plan. These also influence an evaluation of the alternative planning concepts. The four themes are:

a. Natural forces of sun, wind, tide, geology, and biology give the islands their special sense of beauty and wildness and are their major appeal. The contrast between the sense of wildness and the views of the Boston skyline reinforce the special nature of the islands.

b. Harbor geography provides the theme for organizing the Harbor Islands State Park. The subtle differences of each island are due to its unique position in the harbor. Park organization, development, and interpretation are based on the concept of orienting the visitor to his location within the harbor and maximizing the use of lookout points to "preview" what can be found on other islands. These concepts can and should be implemented for both Deer and Nut Island as well.

c. Harbor transportation is a major portion of any visit to the harbor islands. Shipping traffic, commuter ferries, fishing vessels, island taxis, and recreational boating all focus attention on the fact that the major portion of the harbor is water rather than islands.

d. Harbor history relates the historic development of the entire region and can cover the range from prehistoric settlements to the present. Historic remains and structures are extant on all the islands and are proposed as a strong feature of the park. Deer Island and Nut Island can share by preserving and reusing, where possible, on-site historical structures and by providing unique vantage points from which to view the history and development of the harbor.

6.4.7 CONCEPTUAL TREATMENT PROCESS LAYOUT DESIGN CRITERIA

Deer Island

The program of engineering needs at Deer Island requires that the entire island be available to construct the plant and to provide a buffer zone to that plant. The plant's construction will require that much of the existing treatment plant be substantially modified or abandoned. the plant's size also requires that the area presently occupied by the prison complex be available for construction of the new plant.

The conceptual treatment process layouts selected are refinements of the layouts presented in the Final Environmental Impact Report on Siting Options (FEIR). The tankage and configurations presented are intended to convey a visual impression of a treatment facility. The final configuration will be a synthesis of the three concurrent facility planning efforts: the Secondary Treatment Facility Plan (STFP), the Residuals Management Facility Plan (RMFP), and the site access (pier) study. Conceptual treatment process layouts for Deer Island indicate the existence of five zones related to the treatment plant facilities and its ancillary support facilities.

- o Zone 1: Primary treatment
- o Zone 2: Secondary treatment
- o Zone 3: Residuals processing
- o Zone 4: Administration and maintenance
- o Zone 5: Pier facilities

Areas for Zones 1 and 3 are considered to be interchangeable at this point of the studies. These areas may be switched or blended together as engineering studies proceed further. The degree of residual processing that may take place off-island will be established by subsequent studies.

The area needs of these various zones are based at this time upon layouts developed for the siting FEIR, preliminary unit process criteria information being assembled for the STFP, and preliminary information being prepared for the pier facilities. For the purposes of these layouts, the secondary treatment was assumed to consist of activated sludge as shown in the FEIR. The areas of the main process zones are:

- o Zone 1: 20-28 acres
- o Zone 2: 40-46 acres
- o Zone 3: 24-30 acres

The area, or footprint, occupied by the treatment process when completed is the sum of Zones 1, 2 and 3 or 64 to 98 acres. Additional area will be required for conveyance conduits, pump stations, administration, maintenance, and ancillary facilities. Area will also be necessary during construction for staging, concrete batching, and on and off island movement of materials. The evaluation of visual appearance conducted within this document is focused on the completed facilities. For comparison purposes a contiguous footprint of 110 acres for the main process zones has been utilized herein.

The elevations of Zones 1 and 2 are based upon preliminary hydraulic analysis that indicates a 16 ft hydraulic gradient for conventional secondary treatment alternatives. The layouts assume influent pumping with gravity flow through the plant. Influent to the Zone 1 primary facilities was assumed to be at elevation 137 ft MDCSD; effluent from the Zone 2 secondary facilities was assumed to be discharged at elevation 121 ft MDCSD.

The conceptual layouts presented indicate that the existing pump station will remain at Deer Island. There will be other buildings included in the final plan. The exact number, size and

height of those buildings is not yet known. For reference purposes, the reader may assume that such buildings could be similar in size to the existing pump station structure.

Nut Island

At Nut Island the MWRA intends to abandon the existing primary treatment plant and to construct a headworks facility. The headworks facility would be sized to accommodate the south system flows. The headworks would provide preliminary treatment (screening and grit removal) to the wastewater.

Identification of sites for the headworks on Nut Island is heavily encumbered by the existing plant's facilities, that occupy almost the entire site, and the need to maintain the operation of the existing plant's facilities during construction. With the exception of the open grassed areas located adjacent to the primary basins on the easterly and southerly sides of the site, areas that are near to and/or abutt the site's neighbors, there are no open spaces on the Nut Island Site adequate to construct a new headworks facility without impacting a portion of the existing plant's facilities. Currently are three options have been identified for consideration for siting the headworks structure. They are:

- o Locate the headworks on the northeast corner of the site, in the area currently occupied by the four anaerobic digesters.

- o Locate the headworks on the northwest corner of the site in the area currently occupied by the chlorination building.

- o Locate the headworks structure in the corridor defined by the primary sedimentation tanks and the eastern shore of the Nut Island peninsula. This corridor extends from the existing gas storage sphere to the southern property line of the treatment plant.

Development of options for siting the headworks is based on the assumption that continuous operation of the Nut Island treatment plant throughout construction and start-up of the headwork facilities will be required. Subsequent, technical evaluations of the siting of the Nut Island headworks will evaluate the maintenance of plant operations for the three options cited, and may result in other options identified as also being feasible. Briefly, however, it is noted that the option that impacts the existing digesters would require the availability of alternative interim sludge handling procedures and/or facilities not presently envisioned or scheduled, and the option that impacts the chlorination facilities would require implementation of interim disinfection methods not presently scheduled.

Based upon available information on South System flows, a preliminary sizing of the headworks has been done. The footprint of the proposed headworks would cover an area of approximately 140 ft by 180 ft. The headworks superstructure would be approximately 35 ft above the ground surface. To accommodate aesthetic considerations this height might be reduced upon further engineering evaluation.

6.4.8 CONSTRAINTS AND OPPORTUNITIES

Three primary groups of considerations emerged from the background definition studies that influence directly the planning, design, and evaluation of alternative concepts for both Deer Island and Nut Island. They are the social, technical, and environmental considerations, which have been analyzed with regard to the constraints and opportunities that they represent.

Given the preliminary and conceptual nature of the harbor perspective study, costs and financial effects, jurisdictional implications, judicial concand institutional/implementability issues have not been made explicit at this time, but they are implicit in the selected alternatives identified. Subsequent phases of the facilities plan will address these latter issues in great detail, and the final recommended plan will be derived from a complete analysis and evaluation of all MWRA and regulatory agency criteria.

Social Considerations

- Construction Activities: Minimize construction activities in the immediate proximity of abutting communities. Create landform and landscape screening and buffers between the abutting communities and the treatment facilities to reduce visual and noise impacts.

- Noise: Noise producing zones of the project facilities should be placed away from adjacent residential communities. Buffer zones of trees

, shrubs, and earthen berms can further screen noise.

- Odor: Engineer the facilities to meet a committment that there be no detectable odor off-site. To help achieve this standard place those zones with the greatest odor potential furthest from adjacent communities, and consistent with prevailing wind conditions. Consider buffer zones and other design means to achieve the standard established.

- Visual: Either minimize or maximize the visual impact from the harbor by either highlighting the technological aspects or screening the view of the plant. For concepts that minimize the visual impact on adjacent communities, screen the view of the plant facilities by berms and plantings. Consider the recreation of the natural image of the "Wilderness Islands", the Olmsted vision to reforest the harbor islands, and recognize through design the gateway context of both islands.

- Recreational Opportunities: Where it is consistent with the treatment facilities engineering needs, create multi-use recreational zones in appropriate areas of the MWRA project sites. Orient the recreational zones for use by the abutting communities and/or the general public, and to the maximum extent possible make shoreline and scenic vantage points available.

- o Adjacent Land Use and Community Character: Accommodate the passive, residential character of adjacent areas. Encourage local, community based recreational potential of the project sites. Develop footpaths and bike trails linked to adjacent residential roads, shoreline area, and paths. Make a harmonious transition between the character of the adjacent communities and the development on the project sites.

- o Property Values: This issue is addressed within this technical memorandum through the impacts identified in the previous sections on adjacent land use and community character.

- o Scenic Quality: Consider the collective visual memory of Boston Harbor and of the project sites from post-glacial formation of drumlins to prehistoric settlements, through the colonial period to the present. Recreate a sense of the scenic visual image of the drumlins, which either exist on the project sites today or had been on the sites in the past. Maintain and enhance, in particular, the scenic quality of the water edges of the project sites.

- o Historical/Archaeological: Consider ways to preserve the three historic structures (old pump house, Hill Prison, and the prison superintendent's residence) on Deer Island designated as eligible for nomination to the National Register of Historic Places. Consider ways to minimize impact to identified cemeteries.

- o Future Plans: Consider the many opportunities presented by the Harbor Islands State Park including the expanding water transportation systems, improvements in information transfer, and island support facilities. Consider the educational potential of the project sites and the new technologies that the proposed plant facilities may engender. The public, especially the youth, might be allowed to view and tour the facilities through carefully prepared site visits.

Technical Considerations
Zoning - Maintain continuous operation of existing treatment facilities at the project sites during construction and start-up of new facilities.

Develop five functional zones on Deer Island as follows:

- o Zone 1: Primary treatment
- o Zone 2: Secondary treatment
- o Zone 3: Residuals processing
- o Zone 4: Administration and maintenance
- o Zone 5: Pier facilities

On Nut Island provide two functional zones as follows:

- o Zone 1: Headworks and access road
- o Zone 2: Pier facilities

Areas - On Deer Island provide the following minimum areas for treatment process Zones 1 through 3:

- o Zone 1: 20-28 acres
- o Zone 2: 40-46 acres
- o Zone 3: 24-30 acres

On Nut Island provide a minimum area of 1.7 to 2.4 acres for the headworks.
Site Grading - Preliminary calculations of the required site grading for Deer Island were based upon the preliminary hydraulic analysis of the treatment plant process flows and an analysis of the existing geology and topography of the site. There will be two major elements of site grading: removal of the central drumlin and excavation for the treatment process basins.

The excavated volume from the central drumlin and the remainder of the site down to a basic elevation of 125 ft MDCSD was calculated to be approximately three million cubic yards.

The volume of excavation for the various treatment plant process basins and structures was calculated to range from approximately 600,000 cubic yards to 1.5 million cubic yards based upon the depth of burial for each of the process basins.

The total volume of site excavation from both these areas, therefore, can range from 3.6 million to 4.5 million cubic yards. On Deer Island preliminary hydraulics analysis indicates that a 16 ft hydraulic gradient would be necessary for conventional secondary treatment alternatives. Effluent from the Zone 2 treatment facilities can be assumed to be discharged at elevation 121 ft MDCSD.

On Nut Island the above-grade structure of the headworks can be assumed to commence at elevation 122.5 ft MDCSD.

Site Security - Control the access to the sites by a perimeter fence around the plant facilities with a minimum number of control gates. Accommodate the barging of materials to and from the project sites. Discourage major vehicular movement to and from the project sites. Provide clear separation between publicly accessible areas and those occupied by the treatment facilities.

Traffic - Minimize off-island movement of materials by re-utilizing on-island as much as possible the approximately 4 million cubic yards of excavated earth at Deer Island. Encourage water access to and from Deer Island to reduce vehicular traffic through adjacent residential community.

Environmental Considerations

Natural Forces - The major constraint in this group relates to providing protection for the extreme flooding that results from the frequent simultaneous occurrence of hurricanes or northeasterly gales and the perigean spring tides. Designs for Deer Island should provide protection for flood elevation and wave levels of 117 ft MDCSD, while for Nut Island 122 ft

MDCSD should be used. Wind direction and sun angles in various seasons are corollary, but are less stringent design considerations.

Landforms, Vegetation, and Wildlife - Consider the maintenance and/or recreation of micro-environments that can provide survival niches from the exposed coastal conditions at the project sites. Landforms creating shelter from the wind will afford greater opportunities for the survival of trees, shrubs, and other plant and animal species.

Human Environments - Consider concepts of placemaking where it will be suitable for the structures related to administrative and operations staff to be located. Create or maintain micro environments both outdoors and indoors where the public would be apt to participate in multi-use recreational activities.

Section 7

7.0 ENVIRONMENTAL REVIEW

7.1 PREVIOUS REVIEWS

7.1.1 INTRODUCTION

Public concern about the quality of Boston Harbor water, and what to do about the odor and health problems caused by the discharges of raw and untreated sewage into the near-shore areas, dates back to the first half of the 19th century. However, it was not until the first half of this century that the first studies were conducted in an attempt to remedy the overall situation.

By the mid 1930s, public consternation about the harbor's water pollution problem prompted the creation of a "Special Commission on the Investigation of the Discharge of Sewage into Boston Harbor and its Tributaries." The Commission, which made detailed studies of the effects of the Nut, Deer, and Moon Island raw sewage discharges, concluded that the harbor could assimilate the sewage if primary treatment were used to remove floating solids and the outfalls were extended further out into the harbor to stop the build-up of sludge deposits that was occurring.

In response to the Commission's report, and in compliance with its recommendations, steps were taken to install primary treatment and to extend the outfall lines so that both treated effluent and processed primary sludges could be discharged further out into the harbor.

Construction of the primary treatment works at Nut Island was completed in 1952. Sixteen years later, in 1968, the Deer Island plant, which also handles the flow from Moon Island, went on line.

Despite the construction of these projects, the quality of water in Boston's harbor continued to receive attention and scrutiny by both federal and state officials.

7.1.2 THE DEEP TUNNEL PLAN FOR CSOs

In 1967, a year prior to the completion of the Deer Island project, the City of Boston hired a consultant to find a solution to the City's combined storm-sanitary sewer overflow (CSO) problem. The project recommended by the City's consultant -- a "Deep Tunnel" which would store excess flows for later treatment -- was never implemented because of its $430 million cost.

7.1.3 THE FEDERAL ENFORCEMENT STUDY

In 1968, the year the Deer Island plant came on line, a federal study was released charging that almost one third of Boston Harbor was "grossly polluted". This report triggered a series

of three federal "Enforcement Conferences" on Boston Harbor, the first in that same year, 1968; the last in 1971.

7.1.4 EARLY STATE STUDIES

During this same three year period, the Massachusetts Division of Water Pollution Control (DWPC) also conducted a number of studies on Boston Harbor. Certain of these claimed that the treated primary effluent itself did not have an adverse effect on the harbor's water quality. However, another, released in 1971, claimed that the historical practice of discharging digested sewage solids with the effluent on the outgoing tide was causing harmful quantities of sludge to accumulate on the harbor floor.

The series of Federal Enforcement Conferences and the 1971 analysis of the sludge deposit problems led to two major and more far reaching studies. One of these was the "Boston Harbor Eastern Massachusetts Metropolitan Area Wastewater Management and Engineering Study" (EMMA). EMMA resulted from an agreement among the parties to the Federal Enforcement Conferences -- the MDC, the Massachusetts DWPC, and the U.S. EPA -- to make a comprehensive review of the harbor's water pollution problems and to set out just what would be required to clean it up. The other study, stemming from a separate agreement between the MDC and the DWPC, was to develop an acceptable method for disposing of the wastewater sludges from the Nut and Deer Island plants.

7.1.5 THE EMMA STUDY

Taking just over three years to complete, the EMMA study was intended to provide a 50-year master plan for the MDC's sewerage system and treatment facilities. Among the subjects to be addressed were the long term operation and capital maintenance requirements of the MDC's sewerage and treatment system, and an assessment of the additional system capacity that would have to be constructed to service future growth in the area.

In October 1972, Congress enacted the "Federal Water Pollution Control Act Amendments," (P.L. 92-500) (FWPCAA), which caused the scope of the study to be further expanded. In anticipation of the new law's requirements, the EMMA study included options that would allow the MDC to comply with the new statute's municipal clean-up requirement of secondary treatment -- a level of treatment capable of removing approximately 85 percent of the pollutants in raw wastewater.

When they were released in the spring of 1976, the EMMA study's recommendations proved to be highly controversial. At issue were the plan's recommendations for full secondary treatment of flows to the Nut and Deer Island plants, and for two new advanced waste treatment (AWT) satellite plants that would discharge to the Charles and Neponset Rivers.

7.1.6 ASSESSING THE IMPACT OF THE EMMA STUDY RECOMMENDATIONS

EPA decided that an environmental impact statement should be prepared on the EMMA study recommendations before any of the fifty-two projects proposed by the plan were implemented. However, long before the EIS process was completed, one of the proposed projects -- to provide secondary treatment capacity at Nut Island -- was effectively eliminated by an act of the state legislature.

In order to expand and upgrade the Nut Island facilities, approximately 28 acres of Quincy Bay would have to be filled in. Public opposition to this was so strong that, in 1977, the Massachusetts legislature passed a bill that precluded any such activity, at least for the purpose of building a wastewater treatment plant. Absent the additional "land," the Nut Island recommendation was effectively killed.

Two other projects, the AWT satellite plants, were eliminated by the EPA during the EIS development process. Mathematical models used to assess the impact these two projects would make on the Neponset and Charles Rivers indicated that water quality would be adversely, not beneficially, affected. Consequently, these two projects were effectively eliminated from further consideration.

Yet another analysis showed that the cost of fixing the problems at the Nut Island primary facility were almost equal to the cost of building a completely new primary treatment unit. Consequently, there was little EPA could do but look at consolidated approaches to solving the harbor's water pollution problem.

When it was issued in September 1978, the draft final EIS recommended that both primary and secondary treatment of all wastewater flows be provided at Deer Island. However, this configuration proved to be no less controversial to area residents than prior approaches.

Chief among the concerns of area residents was the additional stress that this new project would place on their already overburdened environment. This was particularly true for residents of the town of Winthrop, who were already burdened with noise from Logan Airport, odors from the existing Deer Island plant, and the presence of the Suffolk County House of Correction, also on Deer Island. As a result, EPA was not able to finalize the EIS, and the matter languished.

7.1.7 OCEAN DISCHARGE WAIVER APPLICATION STUDIES

At the same time that the EPA was preparing the EIS, the MDC was undertaking studies and reviews to take advantage of a newly adopted provision of the Federal Clean Water Act. The amendment, one of several adopted by Congress in 1977, authorized EPA to grant waivers from the law's minimum secondary treatment requirement to communities discharging to marine or ocean waters.

The new provision, often referred to by its section number in the amended statute -- 301(h) -- would allow coastal communities to apply less than full secondary treatment to their wastewater discharges so long as certain environmental safeguards were assured. To obtain the waiver, communities were required to show that:

- o There were applicable water quality standards for the affected waters;
- o The lower level of treatment would not hinder the attainment of the Act's fishable/swimmable goal;
- o A system of monitoring the effects of the discharge that would occur was established;
- o The reduced level of treatment would not impose greater levels of treatment or other types of pollution controls elsewhere;
- o All germane industrial pretreatment requirements would be enforced;
- o A program and schedule for eliminating toxic pollutants from the discharge existed; and
- o There would be no increases in the levels of the pollutants in.the discharge, once the permit was granted.

In order to illustrate its ability to comply with these statutory caveats, the MDC initiated a study in 1978, and appended the resulting report to its "301(h) waiver" application when it was filed with the EPA on September 13, 1979. Three addenda to the application were submitted in 1982. In June 1983, the EPA tentatively denied the application.

In mid 1984, the MDC submitted a revised application for the section 301(h) waiver, and a few months later, in October 1984, yet another addendum in further support of its final attempt to obtain this measure of relief.

On March 29, 1985, U.S. EPA tentatively denied the granting of the 301(h) waiver to the MDC, on the grounds that any level of treatment less than secondary was likely to impair water quality and adversely affect the harbor's marine ecosystem. In its decision document, EPA also claimed that the MDC's programs and submissions for addressing the waiver section's requirements for monitoring, pretreatment enforcement, and the control of toxics, were deficient in one way or another. Accordingly, EPA determined that the MDC should proceed with the implementation of full secondary treatment as called for by the federal law.

7.1.8 THE PHASE 1 SITE OPTIONS STUDY

In April of 1978, EPA and the MDC entered into an agreement that was intended to have the MDC move forward with certain projects that would be required regardless of the outcome of the

pending EIS or the 301(h) waiver application. Consequently, in accordance with this agreement, the MDC initiated a two-phase facilities planning effort. The purpose of the first phase was to identify the various options for locating the treatment facilities that would be required, depending on the level of treatment ultimately determined to be necessary.

In June 1982, the MDC issued its consultant's report on the "Phase 1 Site Options Study." With regard to the short term, the study concluded that the "existing MDC primary treatment facilities at Deer Island and Nut Island are in need of immediate upgrading to improve wastewater treatment at each facility". With regard to the long term, however, the study confirmed the need "to provide the substantial facility improvements necessary for future treatment needs and protection of Harbor resources", and set forth twelve siting options.

With regard to their configurations, 7 of the options involved secondary treatment with local outfalls, 2 involved upgraded primary treatment with a new deep ocean outfall equipped with diffusers, and 3 involved upgraded primary treatment with diffused local outfalls. Generally, each option involved the use of space at Deer, Nut, or Long Island, or some combination of the three.

In addition to identifying the available options, the Phase 1 report also provided a general characterization and evaluation of each option. However, the report stopped short of making an actual recommendation, due in part to the fact that the 301(h) waiver application was still pending.

7.1.9 THE SUPPLEMENTAL DRAFT EIS

At about the same time that the MDC's consultant was finalizing the Phase 1 Site Options Study, EPA elected to update the earlier Draft EIS that had been prepared on the EMMA study recommendations, but never finalized. This time, however, the review would focus on the options presented in the Phase 1 Site Options Study.

Finalized in December 1984, and released in January 1985, the "Supplemental Draft Environmental Impact Statement" (SDEIS) provided assessments of 7 alternatives, having first expanded the Phase 1 Site Options Study's list of 12 options to 22. Included among the new options were two that would consolidate all of the treatment on Long Island; a new "satellite" AWT treatment facility which would discharge into area wetlands for effluent polishing; and a proposal that would locate facilities on new man-made sites in the outer harbor area. Here again, however, no decision was made with respect to recommending any particular option. There were several reasons for this.

First, and perhaps most significantly, EPA and state officials were aware of the strong feelings about this entire matter among the public in general, and the Commonwealth's legislators in particular, and therefore the need to provide an additional opportunity for public review and comment. Further, given that the door had already been opened to the public at the beginning of the SDEIS process with the holding of "Public Scoping Meetings," and that these meetings had in fact led to the inclusion of several new options, it was deemed both

prudent and necessary to continue to allow the public to be an integral part of the review and assessment process.

Second, EPA officials felt that prior to selecting a preferred site, a set of selection criteria should be developed. Accordingly, they elected to use this SDEIS as the vehicle for accomplishing that objective.

Third, EPA had yet to make a decision with respect to the MDC's 301(h) ocean discharge waiver application. Because the level of treatment had a significant bearing on the acceptability of, or need for, one option over another, it was virtually impossible to choose the "best" way to go.

Yet another factor was the need to give consideration to issues other than those directly linked to water quality. Therefore, in addition to the environmental, social and economic criteria normally used in this process, EPA also assessed the legal, institutional, and political ramifications of each option. In doing so, it was found that all of the options were deficient in one way or another. Each had at least one significant, adverse impact on the interests of one group or another, and none of them satisfied all of the screening criteria.

Selecting Seven Options

Absent a clear set of preferential options, EPA proceeded to shorten the list by selecting those with the most advantageous characteristics. Initially, this led to the selection of eight options, four involving secondary treatment and four with primary treatment. Additional evaluations, however, eliminated one of the primary options, that of providing all primary treatment on Long Island. The reasons: the need for 52 acres of land; significant legal and institutional obstacles; an adverse impact on a planned state park and the existing Chronic Disease Hospital; construction constraints; and costs which would be significantly greater than those for the other primary options.

Imposing Conditions on Alternate Sites

Having selected what it believed to be the most viable approaches, EPA was then faced with the task of determining what "conditions" would be necessary for each of these seven options, which included:

1. Providing full secondary treatment of all flows at Deer Island, with a local (short) outfall;

2. Splitting the provision of secondary treatment between the Deer and Nut Island plants, both with local outfalls;

3. Providing full secondary treatment of all flows at a new Long Island site, with both plants using local outfalls;

4. Splitting the provision of secondary treatment between the Deer and Long

Island sites, again using local outfalls:

5. Providing primary treatment of all flows at Deer Island with a long outfall;

6. Splitting the provision of primary treatment between Deer and Nut Islands, with a long outfall serving both facilities; and

7. Splitting the provision of primary treatment between the Deer Island plant and a new, smaller primary facility at Long Island, again, with a long outfall serving both facilities.

Of concern was the identification of mitigation measures that would be necessary in order to minimize identified adverse site impacts that were unavoidable, but, nonetheless, unacceptable, including:

- o The impact of transporting massive quantities of materials to the respective construction sites;

- o The effects of large numbers of site workers that converge on already congested, relatively residential areas each day;

- o The effects of construction noise on area residents in neighborhoods immediately adjacent to or near the proposed project sites; and

- o The need to minimize and control odors from the existing plant sites, especially during the construction periods.

With respect to the transportation related issues, EPA required that materials be barged to the site, and that construction busses be provided to bring construction workers in from outlying locations, thus avoiding extra vehicular traffic and its accompanying noise in adjacent neighborhoods.

With respect to the concerns about construction noise, EPA made several stipulations. This included (a) the use of equipment mufflers, and (b) the use of equipment specially designed to minimize noise during use. EPA also stipulated that all work was to be performed in compliance with local area noise control ordinances.

EPA also stipulated that the MDC utilize odor control equipment at all of the respective sites, and that for the Long Island secondary treatment option, the local area hospital be relocated.

As noted previously, EPA also intended that the SDEIS be used to establish the criteria with which each option would be rated. Accordingly, when the Agency issued the SDEIS for public comment, it proposed that each option be rated with respect to:

- o Its effect on the quality of the overall harbor environment;

- Its impact on area neighborhoods, and neighboring groups or institutions;
- The impact on area natural resources and cultural characteristics;
- The extent to which it could be reasonably and expeditiously implemented;
- Its cost-effectiveness, and its affordability;
- Its costs; and
- The actual (or at least perceived) reliability of the option.

In addition to addressing the various impacts of the alternate treatment plant sites, the SDEIS also identified certain issues which, while not having a material or limiting impact on site selection, were nonetheless significant in their own right. Foremost among these was the question of how to handle the disposal of the solids, or sludges, that would be generated by the expanded treatment facilities, regardless of the option chosen. The reasons for this level of concern stem from earlier studies and assessments.

Environmental Assessments of Sludge Management Options

About the same time that the EMMA plan was being developed, the MDC, pursuant to its agreement with the State Division of Water Pollution Control, was conducting a separate review and assessment of sludge disposal options. The resulting "Sludge Management Plan," which was made public in 1973, recommended incineration of all sludges at the Deer Island plant site as the most environmentally sound option.

The MDC, intent on obtaining a federal grant to help pay for the costs of constructing the proposed incineration facility, prepared an environmental impact report (EIR) and submitted it to the U.S. EPA for review. Citizen opposition to the plan at an April 1975 hearing, along with EPA's own misgivings about incineration, prompted EPA to prepare a full environmental impact statement (EIS) on the contemplated sludge incineration project.

The EIS, completed in February 1976, just weeks before the EMMA study's results were made public, confirmed the initial finding that incineration was environmentally more desirable than any other option, including land application or ocean disposal.

In compliance with the requirements of the Massachusetts Environmental Policy Act (MEPA), EPA forwarded its draft EIS on the sludge disposal plan to the state's Secretary of Environmental Affairs for further review. This time, however, the project did not fare as well. Arguing that the original study's examination of the alternatives to incineration was deficient, the Secretary's office decreed that further study of the land application and other sludge disposal options would be necessary before it could approve the project.

The New Sludge Management Plan

Three years later, with the additional information in hand, EPA once again concluded that incineration continued to offer the most environmentally sound option for disposing of the Nut and Deer Island Treatment Plant sludges. However, when it released the draft of final EIS in March of 1979, EPA stipulated that before proceeding, the now 6 year old Sludge Management Plan should be updated.

Many area residents and the Massachusetts Environmental Affairs Secretary's Office were also still strongly opposed to the project, and the new draft EIS did little to alter their position. At issue were allegations by the public that the potential implications of air pollution from the incinerator had not been adequately taken into consideration. The Environmental Secretary's Office was also concerned that the data used to evaluate both the incineration and sludge composting options were insufficient for drawing the stated conclusions. Accordingly, the Secretary decreed that the project was not in compliance with the state's MEPA statute, and efforts to remedy the residual solids (disposal) problems languished until the present.

The MWRA is currently working to complete a Long-Term Residuals Management Faciities Plan which is scheduled for completion in 1988. (See Section 3.3 in this Volume.)

7.2 THE MEPA PROCESS

In response to the MWRA's June, 1986 filing of the Environmental Notification Form (ENF), in November of 1986 the Commonwealth of Massachusetts Secretary of Environmental of Affairs issued a certificate establishing the proposed Secondary Treatment Facilities as a "Major and Complicated" project. The text of that certificate follows:

November 21, 1986

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ESTABLISHING THE SPECIAL PROCEDURE FOR A
MAJOR AND COMPLICATED PROJECT

PROJECT NAME	Deer Island Wastewater Treatment Facilities Plan and Construction
PROJECT LOCATION	Winthrop, Boston, Quincy, and Chelsea
EOEA NUMBER	6136
PROJECT PROPONENT	Massachusetts Water Resources Authority (MWRA)
DATE NOTICED IN MONITOR	July 9, 1986

This project entails the planning for construction of a secondary wastewater treatment facility at Deer Island to which sewage flows from the northern and southern metropolitan sewerage districts will be transported for treatment and disposal. Planning encompasses preliminary treatment at four remote headworks facilities, transport from these facilities to Deer Island, provision of primary and secondary process facilities and sludge transfer facilities, and transport to and disposal at an outfall site located in Boston Harbor/Massachusetts Bay. The MWRA will assess alternatives for each project element and select a recommended plan for implementation. The MWRA will assess the environmental impacts of the alternatives and the recommended plan and will develop a mitigation program to limit adverse effects during construction and operation.

The MWRA requested in the Environmental Notification Form (ENF) that the project be designated as Major and Complicated under the provisions of 301 CMR 10.10. In my Certificate on the ENF, issued August 8, 1986, I agreed to this designation. Accordingly, pursuant to the M.G.L.C.30,s.62A, I establish herewith a special procedure for evaluation and review of the above project.

BACKGROUND

The Deer Island Facilities Plan (DIFP) is one of a number of related activities leading to the cleanup of Boston Harbor. Following the completion of a Final EIR on wastewater facility siting (EOEA #4911), the MWRA chose Deer Island as the site for a new secondary wastewater treatment plant. Near term improvements of the existing treatment system are currently underway through the Fast Track Improvement Program (EOEA #5041) designed to restore the Deer Island and Nut Island Facilities to their original functioning capacities. Facilities planning and environmental reviews for Residuals Management (sludge, scum, grit and screenings) and Water Transportation Facilities (site access) are currently being prepared under separate projects. For Residuals Management Facilities Plan refer to EOEA #5832 and for Water Transportation Facilities Plan refer to EOEA #5938 (on island facilities) and EOEA #5939 (on shore facilities).

By Federal Court decree, the MWRA must have a completed Facilities Plan for this project by December, 1987, a completed Environmental Review by February, 1988, and must accept a Final Plan by May, 1988. Contingent upon the findings of this planning and review process, the Court has further ordered that the new primary treatment facilities be operational by 1995, including a new under harbor transmission tunnel and ocean outfall, and that new secondary treatment facilities be operational by the end of the century.

STUDY DESIGN

The Court schedule requires that the MWRA undertake an unusually efficient planning, design, and environmental review process. The MWRA has suggested that the project be divided into four major efforts:

1. Early site preparation;

2. Construction of an interisland transport conduit from Nut Island to Deer Island;

3. Construction of an outfall conduit from Deer Island to a discharge structure in Boston Harbor/Massachusetts Bay; and

4. Selection of treatment alternatives and plant construction.

In order to meet construction deadlines, the MWRA proposes to begin the site preparation early and has asked for expedited review of this component of the overall project.

The analysis, design, and review efforts have been divided into 21 major work tasks.

SCOPE REVIEW

Each of the 21 work tasks are further subdivided into work packages for which descriptions of the scope of work are to be developed. These work package scopes shall, after thorough review, serve as the scope for the MEPA review of this project.

The MWRA must provide the work package scopes to my office, to the Citizens Advisory Committee, and to interested agencies and other parties. Notice of the availability of these will be published in the Environmental Monitor and comments will be received for 30 days, after which I shall issue within seven days a statement adopting, or adopting with modifications, these scopes.

SCHEDULE

The study design calls for the preparation and review of separate reports on each task and on some sub-tasks prior to the completion of the draft and final facilities plan and environmental review documents. Many of these reports amount to interim drafts of material to be incorporated into later reports. Thus, I do not propose to review under MEPA all of the reports prepared during this effort. Rather, I have identified key reports that must be filed with MEPA and undergo full review. These comprise the scopes of work discussed above, several of the basic data reports, and environmental review documentation on site preparation, interisland conduits, the ocean outfall, and the treatment plant.

The schedule calls for an accelerated review and MEPA approval of only the Site Preparation component of the project at this time. Timing of the draft documents for the environmental review of the outfall, interisland conduit, and treatment components of the project may be staggered as the project develops. Milestone dates as currently envisioned, and court mandated dates for environmental review are listed below:

1.	Proposed Work Package Scopes	Jan	1987
2.	Draft Evaluation Criteria	Feb	1987
3.	Draft Power Supply and Utilities Plan	Mar	1987

4.	Draft Waste Characterization	Jun	1987
5.	Draft Mitigation Planning	Jun	1987
6.	Draft Flow and Loadings	July	1987
7.	Draft Performance Criteria	July	1987
8.	Draft Site Preparation Env. Review	Aug	1987
9.	Draft Interisland Conduit Env. Review	Sept	1987
10.	Draft Treatment Alternatives Env.	Sept	1987
11.	Draft Outfall Environmental Review	Sept	1987
12.	Final Site Preparation Env. Review	Oct	1987
13.	Draft Environmental Impact Report	Oct	1987*
14.	Final Environmental Impact Report	Feb	1988*

*Federal Court Mandated Dates (Subject to confirmation based on filing by the MWRA on November 14, 1986)

Each of these documents shall be submitted to me for review, notice shall be published in the Environmental Monitor, and they shall made available for a 30-day agency and public review and comment period. A seven day period for my comment shall follow the close of the public comment period. My comments, and others received during the reveiw period, shall be responded to in the next document dealing with a particular subject.

CITIZENS' ADVISORY COMMITTEE

To ensure that important policy decisions will be made in the context of maximum public knowledge and participation, this Special Procedure requires the formation of a Citizens' Advisory Committee (CAC). The CAC will provide advice, recommendations and input into decisions made by me and by the MWRA's facilities planners on both the Deer Island Secondary Treatment and the Residuals Management (EOEA #5832) Facilities Planning projects. Through a nomination process that began in July, 1986, members have been selected to represent a balance of interests so as to fulfill the requirements under both MEPA and the construction grants program administered by DWPC. In addition, personnel from concerned state and federal agencies participate as non voting members of the CAC.

The CAC will have the ability to form subcommittees based on a need to review certain issues and to examine local concerns, particularly with regard to potential sites to be named in the RMFP. The Committee will meet on at least a monthly basis, and the authority's staff and consultants will be available to conduct workshops and subcommittee meetings on topics the CAC deems necessary.

The MWRA shall provide to the CAC copies of all documents produced as part of the study. These may be commented upon by the CAC at the monthly meetings or in writing directly to the MWRA. In addition, each document to be submitted for MEPA review will be provided to the CAC at least 30 days prior to submission. Written comments by the CAC on such documents will be attached to the document and made part of the submission.

It is my intention that members of the CAC shall not be deemed "special state employees" within the meaning of G.L.C. 268A. To that end, I provide that the CAC shall be

constituted informally, shall exist only during the time required to address this project, shall serve without compensation, shall not expend public funds, and shall not be required to issue formal reports or conclusions. Nothing in this charge shall limit the provision of support services to the CAC by the MWRA nor shall it limit the CAC's ability to comment to and advise me during this effort.

The Authority may also wish to establish a Technical Advisory Committee of agency reviewers and independent experts. This group, which should be a small, select committee, can provide agency expertise and scientific peer review to the MWRA with respect to certain elements of these projects; notably the siting of the secondary effluent discharge point. This would go far to assure that the highest technical standards are adhered to and counter any potential suspicion of bias in the results of these efforts.

(Signed)

November 21, 1986 — James S. Hoyte, Secretary

December 14, 1986 — Michael Gritzuk, MWRA

Section 8

8.0 FLOWS AND LOADS

8.1 INTRODUCTION

This section sets forth the results of investigations concerning projected wastewater flows and loadings for the new Deer Island Secondary Treatment Plant. The wastewater and associated pollutants received at the MWRA's treatment facilities originate from a variety of sources: domestic wastewater associated with residential activities; nondomestic wastewater associated with the commercial, industrial, institutional, and other business activities of the region; infiltration and inflow; and stormwater flow. Infiltration and inflow is water other than domestic and nondomestic wastewaters that enters sewers unintentionally, and results from the age, condition and location of the more than 5,000 miles of public sewer pipe tributary to the MWRA's treatment facility. Stormwater flow is the flow that results from the combined systems which carry both wastewater and street drainage and is intentionally allowed into the sewer system.

In preparing estimates of flows and loads, two broad assumptions have been made concerning the Authority's future wastewater treatment strategies.

- The service area will be limited to the communities now named in the Authority's enabling legislation. Only a few small communities at the edge of the Authority's service area are not now served by wastewater collection and treatment facilities and could be considered potential additions to the MWRA's service area. These are residential communities which, if added to current estimates, would represent an increase of only about one percent of the total service area population.

- The new Deer Island Secondary Plant will play a significant role in the Authority's future programs to manage combined sewer overflows (CSO). The existing Deer Island Main Pumping Station, together with the existing conveyance system, has the capacity to deliver large volumes of combined wastewater and stormwater runoff to Deer Island. Wastewater planning for the secondary treatment plant has been conducted under the assumption that the facility at Deer Island would continue to receive a substantial portion of the annual combined flow volume. A 1982 CSO Facilities Plan recommended decentralized storage and additional treatment facilities located throughout the combined sewer service area to treat excess combined flows. As well, a preliminary feasibility analysis of deep tunnel storage for combined sewer overflow control was conducted for the MWRA in 1986. Although the approach to CSO control would be different if the Authority were to adopt a deep tunnel plan it would not have a significantly different impact on the design of the Deer Island Secondary Treatment Facilities. Both methods would store and return CSO, resulting in extended operation at higher than average flow rates.

This section also sets forth the characterization of nonconventional pollutants. The non-conventional pollutants categories are: metals; acids; bases and neutrals; pesticides and PCBs; and volatile organic compounds.

8.2 FLOW ESTIMATES

8.2.1 GENERAL

The volume of wastewater produced in the Authority's service area is directly related to the following factors:

- the sewered population of the service area and the volume of water used by the residents and returned to the sewer system as domestic wastewater.

- the economic activity taking place within the service area which drives area growth and employment and thus the volume of nondomestic wastewater discharged as a result of commercial, industrial, manufacturing and employee usage.

- the rainfall in the service area, which enters the sewer system as infiltration/inflow or as direct stormwater flow, and the groundwater levels in the service area which, when high, add to the volume of infiltration/inflow.

Projections through the year 2020 for each of the sources of wastewater flows are set forth in this section.

8.2.2 DOMESTIC WASTEWATER

The volume of domestic wastewater is a function of the population of the service area, the water use patterns of the residents, and the amount of water used and returned to the sewer system.

Present Population

Residential population, as defined by U.S. Census data, includes standard population as well as students in dormitories and other institutional residents. U.S. Census estimates from July of 1984 showed about 2,046,000 residents within the MWRA's service area.

Population Projections

Most population forecasting models study past trends of growth and extrapolate these trends into the future. Many of these models assume that the future population of a community reflects past growth of that community, past growth of some other community, or growth of the region. The true causes of these past trends in population change are natural change and migration. Natural change is composed of births and deaths. Migration reflects the effect of individuals moving into an area less the number moving out of the area. Some population models incorporate the importance of economic factors in establishing migration patterns.

Projections for the residential population in the MWRA service area were based on the review of two regional forecasts listed below:

- o Metropolitan Area Planning Council (MAPC)
  Regional Decline or Revival: An Interim Population Forecast for the Boston Metropolitan Area 1980-2010 (1982).

- o Metropolitan District Commission (LRWSS)
  Water Supply Study and Environmental Impact Report 2020: Water Demand Projections (1983)

The basis of each forecast is described below:

Metropolitan Area Planning Council (MAPC). The MAPC forecasts were prepared in 1982 to the year 2010 and include 101 communities in eastern Massachusetts. All of the 43 communities in the MWRA service area are included in the MAPC boundary. Review of the regional planning agency population projections is consistent with the required approach to facilities planning population projections set forth by the EPA.

The MAPC model focused on the reformulation of the area's population into smaller household units, including one-parent families and persons living alone. Other factors influencing the analysis include: the shift of women, especially married women, into paid employment; the transformation from manufacturing to a services-based economy and its effects upon family income; the diffusion of workplace and residence to more suburban locations; the continuance of net migration, but at a reduced rate; and the housing prices in the area.

The MAPC has formulated three growth scenarios for the region: low series, mid series and high series, reflecting differing perspectives on future trends in the underlying variables. The mid series projections implicitly assumed that natural increase and net migration would operate in such a manner that the population of the MAPC region would remain the same over time. However, shifts of population would occur within the region. The high and low series project increases and decreases in population of 8 percent compared to mid series population projections by 2010. The high series was based on an increase in fertility and a net migration of zero, while the low series reflected decreased fertility and higher rates of out migration than were assumed in the mid series estimate.

Long Range Water Supply Study. The population forecast set forth in the LRWSS, as prepared in 1983 for the Metropolitan District Commission, was also reviewed for this study. The forecast was based on the Massachusetts Economic Policy Analysis Model developed by the University of Massachusetts, which reflects a direct relationship between the demographic and economic factors of the area. The forecasts are based on the assumption that it is the characteristics of the region's evolving economy (industry composition, business costs, shifting employment, etc.) that will determine the region's future and, through migration, its ultimate population. Important aspects of this model are that it is practically unhindered by past migration patterns and that it focuses on current and projected employment trends as well as the migration patterns associated with those trends.

The study area of the LRWSS consists of a total of 80 communities (44 current MWRA water users and 36 potential future users). Five communities within the MWRA sewer service area (Burlington, Hingham, Reading, Walpole, and Weymouth) were not included in the LRWSS study area. Population figures for these communities were based on estimates developed in previous facilities planning studies.

Conclusion. Figure 8.2.2-1 shows the total MWRA service area population since 1940 along with the MAPC mid and high series population forecasts and the LRWSS forecast. The population projected by LRWSS is approximately 8 percent greater than the MAPC high series model.

For the purposes of this report, we have adopted the MAPC high series total population projections of 2.10 million for the year 2000 and an extrapolated estimate of 2.15 million for the year 2020. The Massachusetts and Boston Metropolitan areas are now going through a change in their underlying economic structure with an inherent uncertainty in the relationship of employment, population, and industrial output. The MAPC model deals with this level of uncertainty to a greater degree than the others because it does not assume that employment in a region forces the population projection for that region. The MAPC high series population projection also provides for recognition of growth in the region that is not factored into the mid series projections. The LRWSS econometric model relies more heavily on the assumption that you live where you work. This assumption is reflected in their higher population projections for 2020.

The sensitivity of this population projection to decisions on wastewater flows is explored in Section 8.2.7.

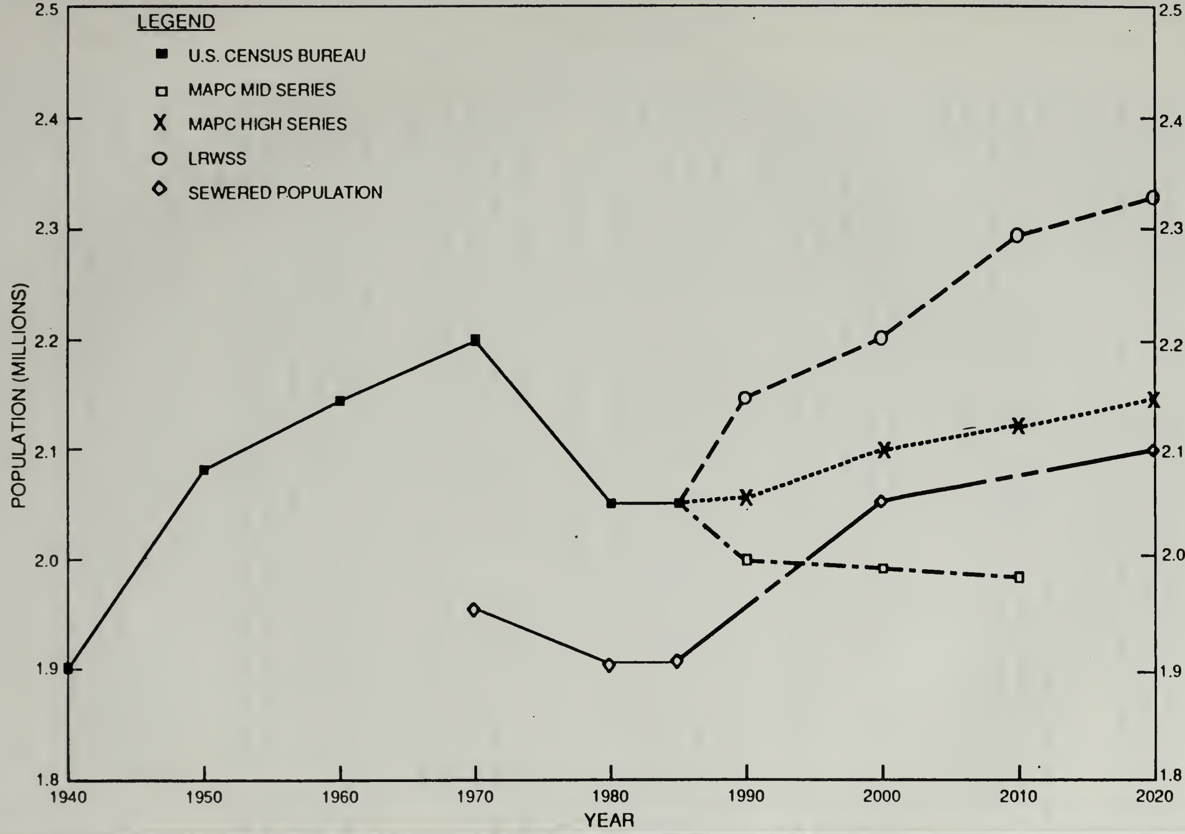
Sewered Population

Based on the 1984 MDC Annual Report, approximately 1.9 million people, or 92 percent of the total population in the service area, were connected to the sewer system. In member communities that are partially sewered, both population changes and projected sewer system extensions have been incorporated in the sewered population projections. As shown in Figure 8.2.2-1, it has been assumed that approximately 98 percent of the total projected population in the design year will be sewered, or 2.1 million people. Not all residents in every community will have sewer service because of cost considerations (construction costs are high for remote areas, high connection and annual charges in areas with existing sewers). Conservatively, it has also been assumed that 98 percent of the total population will be sewered in the year 2000.

Domestic Wastewater Projections

Estimated flow rates of domestic wastewater have been prepared using the residential population projections and estimated water consumption rates of the domestic sector.

The Long Range Water Supply Study (LRWSS) included a detailed analysis of domestic water consumption using 1980 actual consumption data. Average daily domestic per capita water use in the region was found to range from 50-200 gallons per capita per day (gpcd), primarily a



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 8.2.2-1
POPULATION PROJECTIONS FOR MWRA SEWERED SERVICE AREA

function of housing type (ie. single family vs.multi-family, small lot vs. large lot) and the number of persons per household. The current average domestic water consumption rate in the MWRA service area was estimated at 76 gpcd. This estimate includes a 6 percent allowance for the under-registration of domestic meters as estimated by the LRWSS.

The LRWSS estimated that approximately 12 percent of the domestic consumption was seasonal use such as lawn watering, filling of pools, etc. In addition, a small percentage (3 percent) of the water was not returned to the system. Thus, 85 percent of the domestic water used is expected to be discharged to the sewer system as domestic wastewater, or 65 gallons per capita per day.

The LRWSS projected a small reduction in domestic consumption in future years, primarily as a result of plumbing code revisions, increased user charge, and conservation efforts. Because the projected reduction in consumption is small, the future per capita consumption used to estimate future domestic wastewater flows from residential sources is assumed to be the same as observed in the 1980 data. The sensitivity of this projected flow rate to the total wastewater flow projection is analyzed in Section 8.2.7.

Future domestic wastewater flows from residential sources were estimated by applying a per capita wastewater contribution of 65 gallons per capita per day (85 percent of the expected per capita water consumption) to the sewered population projections, summarized in the previous section. Thus the total estimated domestic wastewater expected from residential sources is 133 mgd and 136 mgd in the years 2000 and 2020, respectively.

8.2.3 NONDOMESTIC WASTEWATER PROJECTIONS

Nondomestic wastewater is contributed to the Authority's system from the business activities which take place within the service area. These include process wastewater associated with manufacturing activities, institutional activity, employee-related sanitary wastes, and wastes which are incidental to the service provided by the business. An example of the latter category is the wastewater produced by visitors to the region who occupy hotel rooms.

Estimated volumes of wastewater have been projected over the planning period by subdividing the nondomestic user class into two categories, major and minor, and projecting the contribution from each class separately. The major category is comprised of the 667 major users of the Authority's system. Records of these users are available from the Authority's Industrial Waste Control program files. The minor users are generally commercial business, office buildings and service companies. Estimates of flows from those users have been based on predicted employment in the service area.

Major Nondomestic Users

Data for flows from major nondomestic users has been taken from the 1985 industrial waste records of the Authority. This information is collected by the Authority for use in the pretreatment program, and as part of the Authority's sewer use charge billing system. The

types of companies included in the major category include manufacturing establishments, large institutional users, such as hospitals and schools, and large service companies such as laundries.

Based on the LRWSS and previous facilities planning reports prepared for the MWRA service area, the rate of wastewater flow for the major nondomestic users in the year 2020 has been projected to remain constant at the 1985 discharge level of 43 mgd. While individual companies may undertake steps to reduce their water consumption, or move their operations, it cannot be assumed that all of the major users were at optimum production levels in 1985. Thus, while some existing users may decrease the wastewater discharge rates below existing levels, others may increase above existing levels in response to increased demand for their goods and services, and new discharges may be added.

Minor Nondomestic Users

The category of minor nondomestic users includes all other business activity which takes place in the service area. Unlike the major nondomestic category, which includes a substantial flow component associated with the manufacturing process, the wastewater contribution of the minor nondomestic category is predominantly driven by employee usage. Thus, future levels of minor nondomestic flows have been projected based on future employment in the Authority's service area and assumptions concerning employee water use patterns. While there are limitations in stating a "gallon per employee" figure for wastewater discharge, such a number can be related to employment statistics and employment projections to project wastewater discharge.

Existing employment for the minor nondomestic class of dischargers has been estimated using employment information collected by the Massachusetts Division of Employment Security (DES), and data on employment of the major nondomestic users available through the Authority's Industrial Waste Program. The difference between the two represents the estimated existing minor nondomestic users. The DES data were adjusted upwards by 8 percent to include workers not covered under the Employment Security Act. Current (1985) adjusted DES information shows about 1,432,000 employees working in the service area. Major company employment for the same year has been estimated at 335,000 employees, leaving 1,097,000 as the 1985 estimated minor company employment.

Projections of future employment in the service area have been estimated based upon assumed rates of growth of the economy of the service area presented in previous studies.
Future levels of employment within the greater Boston metropolitan area have been projected by several different organizations. The Boston Edison Company (BECo) has recently forecast employment for its service district through the year 2000. The BECo Service District, which comprises 47 municipalities in the Greater Boston area, overlaps much of the MWRA's sewer service area. Of the 43 communities served by the Authority, 28 are also included in the BECo service territory. The major differences between the service areas exist in the northeast, southeast, and in the western boundaries of the MWRA's service area. Overall, BECo has projected a total increase in employment of approximately 40 percent between 1985 and the year 2010.

The Massachusetts Division of Employment Security has recently forecast changes in employment for the state as a whole through the year 1995. These projections indicate an increase in statewide employment of approximately 15 percent over 1985 employment. Additionally, Arthur D. Little, as part of the LRWSS studies, prepared employment forecasts through the year 2020 for the state as a whole and for various subregions of the state. These forecasts predicted an increase in statewide employment of approximately 20 percent between 1980 and the year 2000, and an additional 21 percent between the years 2000 and 2020.

Since the Arthur D. Little forecast is the only estimate for MWRA and estimates of employment through the year 2020, the results of that study have been adopted for this report.

Adjustments have been made to the forecasted employment to reflect the actual 8.5 percent growth in employment in the MWRA service area which occurred between 1980 and 1985. Accordingly, from 1985 through 2020 it is expected that employment will rise by 30 percent over 1985 levels. Minor company employment is estimated to be 1,426,000 in the design year.

The wastewater contributions associated with total employment in the year 2020 have been based on an allowance of 30 gallons per capita per day for all employees except those engaged in the hotel and food services businesses. For these last two classes of business, which comprise about 1.5 percent and 7 percent of the employment in the region respectively, special allowances have been made to account for the water-intensive nature of the business. Allowances of 150 gal/employee/day for hotels and 180 gal/employee/day for food service have been used for projecting flows. Minor nondomestic flows are estimated at 46 mgd, 50 mgd and 60 mgd respectively in the years 1985, 2000 and 2020.

The average base domestic and nondomestic wastewater projections for the years 1985 to 2020 are shown in Table 8.2.3-1. Maximum daily flows and peak hour flows were based on peaking factors from the Water Pollution Control Federation Manual of Practice No. 9. The total system maximum daily flow of 323 mgd was based on peaking the sums of the total North and South systems average daily flows rather than adding the maximum daily flows for both systems. These estimates do not include infiltration and inflow, which are discussed in the following section.

8.2.4 INFILTRATION AND INFLOW

Infiltration and inflow (I/I) to the sewer system is the sum of infiltration (groundwater that enters the system through cracks in pipes and manholes) and inflow (water that reaches the system through direct connections during and after storm events). Inflow is delivered to the system by roof leaders, sump pumps, catch basins, system defects such as missing or broken manhole covers and frames, and through inoperable or leaking tide gates.

Infiltration/Inflow (I/I) and direct stormwater runoff account for a significant amount of flow in the MWRA sewer system as depicted by the 1984 flow data, shown in Figure 8.2.4-1. Seasonal flow variations are a direct response to variations in I/I. The flow data from 1984, a reasonably wet year, is presented as a 30-day moving average of flow at Deer Island and Nut

TABLE 8.2.3-1

EXISTING AND PROJECTED
WASTEWATER FLOWS

(mgd)

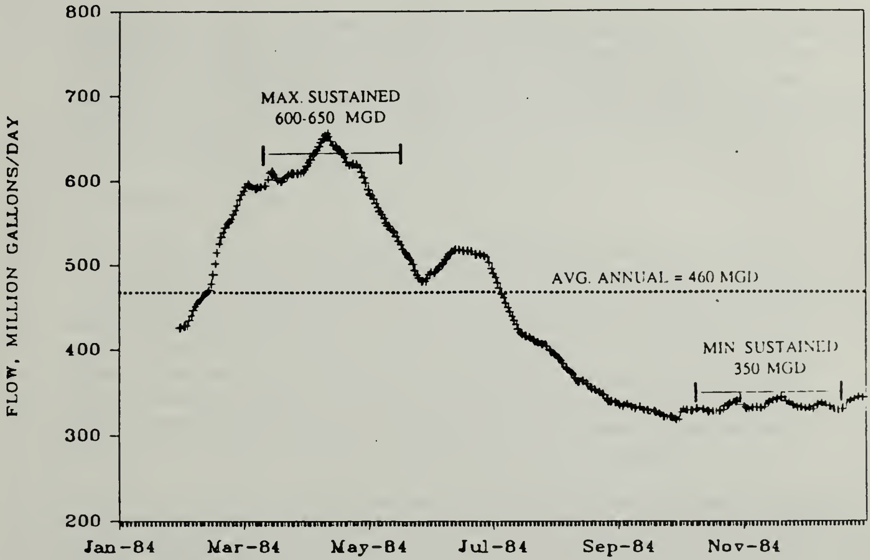
	1985	2000	2020
Domestic	123	133	136
Nondomestic			
Minor Users	46	50	60
Major Users	43	43	43
Total	212	226	239

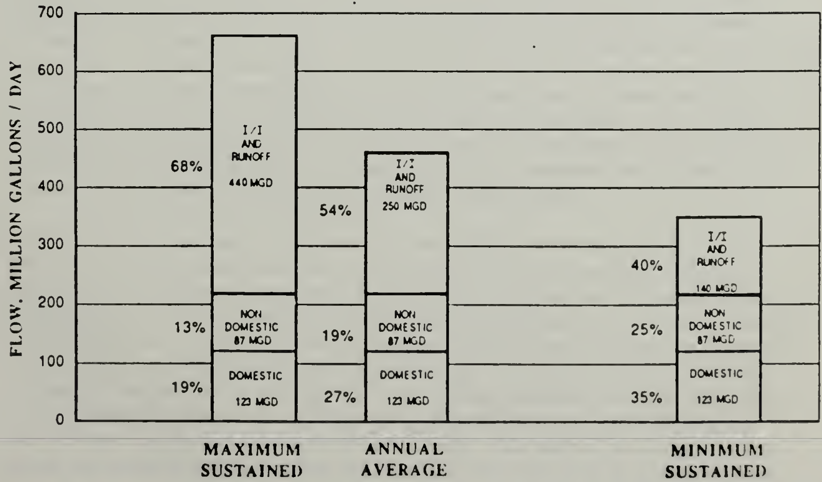
Notes:

1) Domestic wastewater flow based on sewered population and wastewater production of 65 gpcd.

2) Minor nondomestic wastewater flow based on employment trends with wastewater production of 30 gallons per employee per day for all employees except those engaged in the hotel and food service businesses.

3) Major nondomestic wastewater flow assumed static over the planning period.





MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 8.2.4-1
1984 FLOW DATA

Island in Figure 8.2.4-1. As shown, the months February through May have notably higher flows than the remainder of the year due to higher groundwater elevations which result in increased I/I. Due to this phenomenon, I/I flows were estimated for two periods: high groundwater conditions (February - May); and low groundwater conditions (June - January). To determine the magnitude of I/I in the MWRA system, historic flows entering the Deer Island and the Nut Island Plants were examined.

North System

Estimation of I/I flows in the North service area is complicated by several factors. First, a portion of the service area has combined sewers, so analysis of total flows by the components of wastewater, I/I, and stormwater runoff is difficult. Second, the Deer Island Main Pumping Station that pumps most of the flow to the Deer Island plant has been operating with reduced capacity since the late 1970's. For extended periods the plant has had only five of nine pumps available. This requires wastewater flows to be "choked" at the headworks facilities under high flow conditions, resulting in overflows at CSO treatment facilities and other overflow points. Therefore, records of flows at the headworks and the treatment plant are not reliable indicators of total plant flow and require adjustments to be used for estimating I/I flows.

To determine I/I during low groundwater conditions the following method was used. The average daily flows obtained from the Deer Island plant records for the months of June 1984 through January 1985, June 1985 through January 1986 and June 1986 through January 1987 were examined. Flow during these low groundwater months averaged about 260 mgd at Deer Island. During these periods only a small amount of flow was bypassed. Since average domestic and nondomestic wastewater flows were estimated at about 134 mgd, the difference of 126 mgd was estimated to be the baseflow I/I component. To determine I/I during maximum conditions, flows on maximum days were compared to flows on average days. Domestic and nondomestic wastewater flows were assumed to be average daily flows. Data from days without rainfall were used to exclude storm flows. The resulting maximum I/I flow of 158 mgd was also used as the peak hour I/I rate. Peak hour rates are influenced by direct inflow caused by storm events. In the North System inflow from combined sewer areas results in sewers becoming full, causing combined sewer overflows (CSO). The stormwater component of flows will be discussed in a later section.

The method used to calculate I/I flows during periods of high groundwater took into account flows not reaching the Deer Island plant. The magnitude of this bypassed flow during storm periods was determined by an examination of rainfall data during three wet springtime months, March and April 1984 and April 1987. By assuming that 100 percent of the runoff was captured for the 12,900 acre combined sewer area, a maximum additional flow of 40 mgd was estimated. During these months only about 380 mgd reached the plant according to plant records, so an estimated average daily flow of 420 mgd would have reached the plant if more pumping capacity had been available. The I/I flow was determined by the difference between the adjusted total flow, 420 mgd, and the base wastewater flow of 134 mgd. This results in an average day high groundwater period I/I base flow of 286 mgd, or slightly more than twice the average I/I flows during low groundwater conditions. Maximum day high groundwater I/I flows were determined by estimating a peaking factor similar to the method used for low groundwater conditions. For the North System a maximum I/I flow of about 390 mgd was determined As noted earlier,

infiltration rates respond to groundwater levels and, therefore, do not change significantly from day to day. Inflow, however, varies with the magnitude of storm events, changing considerably from day to day and significantly from hour to hour during storms. Because the amounts of infiltration and inflow, respectively, are not known on an individual basis in the North System, peak hour and maximum day I/I quantities were taken to be equal. Existing average, maximum and peak hour I/I flows for the North and South service areas for both low and high groundwater conditions are shown in Table 8.2.4-1. Later in this section, the actual amount of I/I to be accepted at the Deer Island Plant will be established.

South System

The South service area represents all the service area tributary to the Nut Island plant. The South System has only a small percentage of combined sewers, but data from the Nut Island plant shows that storm events cause large increases in flows to the plant. The Nut Island plant has an influent pumping station with a rated capacity of about 280 mgd. However, actual capacity of the pumping station is less than this amount. When flows exceed the available pumping capacity, the excess is bypassed. The bypassed quantities historically have not been recorded, but recent flow measurements show the bypasses to be substantial during major storm events. For example, during late March and early April 1987, when nearly 8 inches of rainfall was recorded during a seven day period, the flow recorded at a flow meter on the High Level Sewer (HLS) just upstream of the Braintree-Weymouth Pumping Station was 350 mgd. The flow from the Braintree-Weymouth Pumping Station during the same period was about 45 mgd. Minor flows were also received from the Hough's Neck Pumping Station located between the Braintree-Weymouth Pumping Station and the Nut Island Plant. Therefore, the total flow received at Nut Island was about 400 mgd. However, only about 250 mgd was pumped into the plant for treatment, resulting in a bypass of about 150 mgd.

To determine the I/I contribution during high groundwater conditions (February to May), plant records were examined and the results of the recent South System Modeling Study were used. Data for three wet springtime months (March and April 1984 and April 1987) were examined to determine average daily flows on days not impacted by rainfall events (direct inflow). The average daily flow was found to be approximately 220 mgd. By subtracting the sum of the estimated domestic and nondomestic flow components of 75 mgd, an estimated I/I baseflow of 145 mgd was determined for this period.

To determine the amount of I/I expected on a maximum day and on a peak hour during maximum day, the amount of direct storm-related inflow should be taken into account. This information was taken from the South System Modeling Study which predicted the inflow associated with a "standard storm."

The Division of Water Pollution Control (DWPC) has established a "standard storm" for determining the amount of inflow that should be accommodated in the design of sewers. The standard storm has a duration of 6 hours, a recurrence interval of one year and produces a rainfall of 1.7 inches. The area tributary to the HLS was modeled and the inflow during a 24-hour period was found to be 90 mgd. The peak hour inflow rate was found to be 155 mgd. Therefore, the total I/I during high groundwater conditions was taken to be 145 mgd for average conditions, 235 mgd for maximum daily flow and 300 mgd for peak hour conditions.

TABLE 8.2.4-1

ESTIMATE OF BASEFLOW INFILTRATION AND

INFLOW FOR NORTH AND SOUTH SERVICE AREAS (mgd)

Low Groundwater Conditions

	Average	Maximum Day	Peak Hour
North Service Area	126	158	158
South Service Area	25	115	180
Total	151	273	338

High Groundwater Conditions

	Average	Maximum Day	Peak Hour
North Service Area	286	390	390
South Service Area	145	235	300
Total	431	625	690

To determine the I/I contribution during low groundwater conditions (June to January), plant records from 1984 through mid-1987 were examined. Average daily flows were about 100 mgd. To estimate I/I flows it was assumed that few, if any, bypasses occurred during this period. Based on estimates of connected population and major and minor nondomestic contributions, the base wastewater flow during that period was approximately 75 mgd. The difference between the total (100 mgd) and the base (75 mgd) was 25 mgd and was taken to be the average I/I during periods of low groundwater conditions.

To determine I/I on a maximum day and on a peak hour during a maximum day, the South System Modeling Study results were utilized. The 25 mgd average I/I was added to the 90 mgd of inflow resulting in a maximum day I/I flow of 115 mgd. The average day I/I was also added to the 155 mgd peak hour inflow resulting in a peak hour I/I flow rate of 180 mgd.

Infiltration and Inflow Summary

Base wastewater flows (domestic and nondomestic) for the year 2020 were added to I/I flows to determine the non-storm wastewater flow to the plant. Stormwater flows will be discussed in the next section. In the North System the transmission system was originally sized to accept storm flows so that all nonstorm flows will reach Deer Island with a considerable amount of additional capacity available for storm conditions. Table 8.2.4-2 shows North System flows without stormwater.

Table 8.2.4-3 shows South System flows for low and high groundwater conditions. At low groundwater conditions all flows reach Nut Island. However, at high groundwater conditions, peak hour flows exceed the unsurcharged capacity of the HLS. The South System Modeling Study determined that the HLS has a maximum hydraulic capacity of 360 mgd without surcharging. Based on estimates of I/I presented in this report, future peak hour flows in the High Level Sewer will be approximately 470 mgd, exceeding the HLS capacity. During future maximum day conditions the flow will approximately equal the HLS capacity. This estimate is slightly higher than the 330 mgd maximum day estimate presented in the South System Modeling Study for a standard storm. The reason for that difference is that this study determined base I/I flows more conservatively using wetter springtime months as compared to average springtime conditions.

In any case during certain hours of the day with high domestic and nondomestic flows and with storms equal to or exceeding the DWPC standard storm, surcharging and bypassing are predicted to occur. In order to prevent these conditions, these excess flows must be reduced. The DWPC is now examining the results of I/I studies in the 21 communities in the South System. Data have yet to be standardized, but preliminary estimates show that it is reasonable to expect that sufficient I/I (especially inflow) could be removed to eliminate excess flow. The MWRA has recently established a task force to develop a policy on infiltration/inflow management. It is expected that the goal of this policy will be the elimination of surcharges and bypasses along the HLS. An important benefit of I/I reduction, in addition to reducing surcharges and bypasses, is reduction of operating costs. Influent pumping and wastewater treatment costs are more a function of average flow conditions which are greatly influenced by average I/I contributions.

TABLE 8.2.4-2

DESIGN YEAR

NORTH SYSTEM FLOWS (mgd)

	Average	Maximum Day	Peak Hour
Low Groundwater Conditions			
Wastewater	154	208	246
Baseflow I/I	126	158	158
Total	280	366	404
High Groundwater Conditions			
	Average	Maximum Day	Peak Hour
Wastewater	154	208	246
Baseflow I/I	286	390	390
Total	440	598	636
Hydraulic Capacity of Transmission System	---	913	913

TABLE 8.2.4-3

DESIGN YEAR

SOUTH SYSTEM FLOWS (mgd)

	Average	Maximum Day	Peak Hour
Low Groundwater Conditions			
Wastewater	85	120	170
I/I	25	115	180
Total	110	235	350
High Groundwater Conditions			
	Average	Maximum Day	Peak Hour
Wastewater	85	120	170
I/I	145	235	300
Total	230	355	470*
Hydraulic Capacity of HLS			360*
Flow Exceeding Capacity			110*

*The hydraulic capacity of the HLS is sufficient to accept the Division of Water Pollution Control's design storm. Thus, flow exceeding capacity (110 mgd) is not a flow that requires treatment by existing regulations.

For this project we believe it is prudent to plan for new facilities with a capacity of 360 mgd, which is equal to the existing hydraulic capacity of the HLS. This design requires the management, by 1995, of approximately 110 mgd of I/I during peak hour conditions. As noted earlier, this sewer capacity will accommodate flows associated with the DWPC's design storm. This decision should be re-examined when the results of the DWPC I/I study are available and as the I/I management policy is fully developed.

This decision should also be reexamined in 1988 when the Braintree-Weymouth Pumping Station Environmental Impact Report is completed. As noted above, the Braintree-Weymouth Pumping Station now discharges flow to the HLS. Under an alternative plan being considered by the Authority, flows from the Braintree-Weymouth interceptor would discharge directly to the Nut Island headworks. The South System Modeling Study examined the capacity of the HLS with the Braintree-Weymouth flows removed and with greater flows in the upstream reaches of the sewer. Under this alternative the hydraulic capacity of the HLS is limited to 325 mgd without surcharging because of hydraulic limitations in upstream reaches of the sewer. The flow from Braintree-Weymouth is about 30 mgd at average conditions and 60 mgd at peak conditions. Therefore, the total flow reaching Nut Island might increase to 385 mgd in the future if Braintree-Weymouth flows are directed to Nut Island. For the present we recommend planning for a 360 mgd capacity for the Nut Island headworks and inter-island conduit. If the Braintree-Weymouth flows are directed to Nut Island, the capacity need only be increased by about 7 percent at the headworks and only about 2 percent at the Deer Island Plant. These changes can be accommodated during facilities design.

8.2.5 STORMWATER

Within the communities of Boston, Brookline, Cambridge, Chelsea and Somerville are approximately 12,900 acres with combined sanitary and storm sewers. During storms, runoff reaches the plant via these combined sewers. Stormwater runoff in excess of the transmission capacity of the sewer system is discharged to nearby water bodies as combined sewer overflow (CSO). The maximum capacity for headworks receiving stormwater runoff, and for the proposed headworks at Nut Island serving the South System service area, is shown below.

	Transmission System Capacity (mgd)
Ward Street	256
Columbus Park	182
Chelsea Creek	350
Winthrop Terminal	125
Subtotal North System	913
Subtotal South System	360
Total	1273 (rounded to 1270 in subsequent tables)

As shown in Table 8.2.5-2, maximum daily non-storm flows will range from 600 mgd to 950 mgd depending on the time of the year. Since the maximum hydraulic capacity of the transport system is approximately 1270 mgd, from 320 to 550 mgd of capacity is available to accept stormwater flows in the North System at maximum day wastewater flow conditions.

Recent proposals for combined sewer overflow management envision storage and pumpback of storm flows to the plant. Flows are planned to range from 200 to 300 mgd over a period of 1 to 2 days. The flow projections used for this study include ample capacity for pumpback of stored CSO.

8.2.6 TOTAL WASTEWATER FLOWS

As shown in Table 8.2.5-1, the total domestic and nondomestic wastewater flow at design year is 239 mgd. Including infiltration and inflow, the total average daily flow during low groundwater conditions is estimated at 390 mgd. At high groundwater conditions, the total flow is estimated to average 670 mgd. Assuming a four-month period of high groundwater and an eight-month period of low groundwater, the annual average flow during non-storm events is approximately 480 mgd. Table 8.2.5-2 shows design year average, maximum and peak hour flows under both low groundwater and high groundwater conditions. Also shown on this table is the total capacity in the transmission system and the treatment facilities available for stormwater flow under the various conditions.

8.2.7 SENSITIVITY ANALYSIS

The flow estimates presented in the previous sections were developed from the best available data. The sensitivity of variations in these estimates and their effects on plant sizing and performance were analyzed.

Wastewater flow estimates for the domestic sector were based on the regional population projections for the service area, combined with estimated per capita water consumption. The domestic wastewater flow represents about 29 percent of the total average day flow in the year 2020. Therefore, variations in domestic flows will not significantly impact total flow arriving at the plant. The sewered population projection could vary if additional outlying communities become members of the MWRA sewer district (i.e., Lynnfield in the North System and Dover, Sharon, Sherborn, and Southborough in the South System). The estimated additional sewered population in 2020 is no more than 5,000 for the North System and 14,500 for the South System. These represent about an additional one percent in the total service area population. Applying the per capita wastewater production rate of 65 gpcd results in only an additional 1.3 mgd. Increasing the projected population for the entire service area by 8 percent, representing the LRWSS population estimate, results in an increase of only 11 mgd over the annual average of 480 mgd. According to the LWRSS, reduction in domestic wastewater flow due to conservation efforts, increased rates, and education could effectively reduce the per capita

TABLE 8.2.5-1

SUMMARY OF AVERAGE DAILY (NONSTORM) FLOW BY YEAR (mgd)

	1985	2000	2020
Total Population	2,050,000	2,100,000	2,150,000
Sewered Population	1,900,000	2,060,000	2,100,000
Domestic Wastewater	123	133	136
Nondomestic Wastewater			
Minor Users	46	50	60
Major Users	43	43	43
Subtotal	212	226	239
Infiltration/Inflow* (Low Groundwater Conditions)	151	151	151
Total	363	377	390
Infiltration/Inflow* (High Groundwater Conditions)	431	431	431
Total	643	657	670
Average Annual Conditions	460	470	480

* It should be noted that the I/I from existing sewers is expected to increase as these systems age. Construction of new sewers will also increase I/I amounts. An on-going rehabilitation program must be undertaken to ensure that I/I allowances do not exceed the system capacity in future years.

TABLE 8.2.5-2

DESIGN YEAR (2020) FLOWS (mgd)

	Low Groundwater Conditions			High Groundwater Conditions		
	Average	Maximum	Peak Hour	Average	Maximum	Peak Hour
Non-Storm Conditions						
Total Flow	390	600	750	970	950	1000
Storm Conditions						
Wastewater Flow	390	600	750	670	950	1000
Storm Capacity	---	550	510	---	320	270
Total Flow	390	1150	1260	670	1270	1270

(Annual Average Flow is 480 mgd based on 4 months of high groundwater conditions and 8 months of low groundwater conditions.)

wastewater production from 65 gpcd to 60 gpcd which equates to a reduction of 10.5 mgd.

The total average nondomestic flow has been estimated at 103 mgd which represents approximately 21 percent of the total average annual flow in the year 2020. A ten percent variation in this flow due to increased industrial or manufacturing activity, or increase in employment in the service area, will not significantly impact the total flow estimate. As presented in Section 8.2.4, the total flows are most sensitive to the volume of infiltration/inflow -- which is the most difficult to quantify, but is however, manageable.

System management can be structured to compensate for any unanticipated increase in domestic or nondomestic wastewater flow through a small reduction in infiltration/inflow (particularly inflow), thus maintaining a relatively static rate of average flow to the plant throughout the planning period.

8.3 CONVENTIONAL POLLUTANT LOADS

8.3.1 GENERAL

Secondary treatment plants remove oxygen-demanding substances and suspended matter from the waste stream. These pollutants are measured as five-day biochemical oxygen demand (BOD) and total suspended solids (TSS), respectively. Discharge permits issued to treatment plants by state and federal regulatory agencies specify the maximum concentration of BOD and TSS which may be discharged by the plant.

The discharge permit recognizes that there is inherent variability in the day-to-day loadings and operation of secondary treatment facilities. Thus, permit limits are specified in terms of concentration and time. MWRA's NPDES permit for secondary treatment has specified that the discharge must contain no more than 30 milligrams per liter (mg/l) BOD or suspended solids on a monthly average basis, not more than 45 mg/l of either pollutant on a weekly average basis, and not more than 50 mg/l of either pollutant on a daily basis. In order to properly design the wastewater plant to meet these limits, the expected conventional pollutant loading entering the plant has been estimated for the design year 2020.

Estimates of future year average annual pollutant loadings were developed using two steps. First, the current plant loadings were ascertained from historical records and recent sampling data. Second, loading allowances were made for the capture of existing dry weather overflows and CSO management as well as allowances for increased solids contributed to the plant as a result of growth in domestic and nondomestic flows. Additional loadings equaling 10 percent of the influent loads were included as an allowance for sidestreams from sludge processing in the sizing of individual unit processes.

8.3.2 TOTAL SUSPENDED SOLIDS LOADS

Existing plant loadings were computed using the combined operating records of the Deer and Nut Island treatment plants for the period from January, 1984 through May, 1986, and the sampling

programs conducted as part of this facilities plan. From plant records the average loading on non-rainfall days was calculated to be 444,000 pounds TSS. The sampling program, conducted in the Fall of 1986 and the Spring of 1987 at the four headworks facilities and the two treatment plants, was designed to characterize the wastewater to be treated. The Fall 1986 sampling program was conducted in a period of essentially no rain, and observed an average influent TSS load of 445,000 pounds per day. Thus the sampling program data showed close agreement with the historic operating data from nonrainfall periods and, therefore, was considered representative of the current average TSS load. During the Spring 1987 sampling period rainfall was frequent and days with no rainfall could not be interpreted as dry weather flows because of snow melt conditions.

Dry weather overflows (DWO) were shown to exist in the sewer system tributary to the Authority's treatment plants. As part of the 1982 CSO plan, the volume of dry weather overflow was estimated at 25 million gallons per day. Since the date of the CSO report, steps have been taken to reduce DWOs in the service area. A study completed for MWRA in January 1987 estimated the range of dry weather overflows at 0.3 to 1 mgd. The capture of 1 mgd of DWO would result in an additional 1300 pounds of suspended solids based on a concentration of 155 mg/l of TSS as measured at the Deer Island Plant.

Increases in both domestic and nondomestic wastewater are expected to occur as a result of increased population and business activity in the service area and as a result of the extension of sewers within the serviced communities. Projections of these two activities indicate an increase of approximately 27 mgd of wastewater flow. At an estimated concentration of 300 mg/l suspended solids, an increase in loadings of 67,500 pounds over current levels is expected from these additional flows. Therefore, total suspended solids loading is expected to reach approximately 515,000 lb/day during average non-storm days.

8.3.3 BOD LOADS

Projections for average day BOD loadings were developed in a manner similar to that used to project suspended solids loads. Existing plant loadings were computed from the operating records of the Deer and Nut Island treatment plants for the period January of 1984 through May of 1986. The total plant average daily loading of BOD on nonrainfall days was 447,000 pounds. The sampling program conducted in Fall of 1986 as part of this facilities plan showed an average daily BOD loading of 500,000 pounds. Because the Fall 1986 sampling was conducted during a period of very low I/I and essentially no stormwater flows to the plant, and is considered reliable data, the BOD loading for that period was considered representative of current average conditions.

As described earlier, dry weather overflows were shown to exist in the sewer system tributary to the Authority's treatment plants. The allowance of 1 million gallons per day would contain approximately 1,500 pounds of BOD based on a concentration of 180 mg/l of BOD as measured at the Deer Island Plant.

Increases in both domestic and nondomestic wastewater are expected to occur as a result of increased population and business activity in the service area and as a result of the extension of sewers within the serviced communities. Projections of these two activities indicate an increase of approximately 27 mgd over current wastewater flows. At an estimated concentration of 300 mg/l of BOD, an increase in the BOD load of 67,500 pounds over the current level is expected.

BOD loadings are expected to reach 570,000 lb/day during average non-storm periods.

8.3.4 STORMWATER LOADS

Estimates for conventional pollutant loads from stormwater were developed by analyzing pollutant mass accumulation over the combined sewer service area. The accumulation of pollutants on the land is primarily a function of land use and time between storms. During a major storm event, runoff carries pollutants on the land surface into the combined sewer system. After the storm event, the mass of pollutants begins to accumulate again. The accumulation continues until the next storm event when all or some of the pollutant mass is carried by runoff to the combined sewer system.

For TSS, the maximum accumulation over the 12,900-acre combined sewer service area average 40 to 50 pounds per acre. This estimate is derived f'rom an average of values ranging from about 75 pounds per acre for commercial and industrial land uses, to about 40 pounds per acre for residential land, and 10 pounds per acre for open space. These are all maximum values developed through calibration of combined sewer models for Boston and other urban areas. The modeling results have also shown that maximum BOD accumulation is generally about 40 percent that of TSS. The total stormwater TSS and BOD loadings conveyed to Deer Island is dependent on the capacity of the interceptor system. For this analysis 60 to 80 percent of the maximum pollutant load was assumed to reach the plant. The calculated total stormwater TSS and BOD loadings are approximately 400,000 lb/day and 165,000 lb/day respectively. These estimates have been compared to plant loadings during the Spring 1987 sampling program and have been found to be reasonable.

As noted earlier, recent proposals for CSO management envision storage and pumpback of stormflow to the plants. The TSS and BOD loadings of 284,000 lb/day and 162,000 lb/day respectively used in these proposals fall within the allowances used in this study.

8.3.5 LOAD VARIABILITY

Table 8.3.5-1 shows the variability in conventional pollutant loadings for the planning period 1990 to 2020. Peaking factors for maximum day, maximum three-day and maximum month were based on Nut Island plant records of 1975 through 1980 as reported in the Commonwealth of Massachusetts Nut Island Wastewater Treatment Plant Facilities Planning Project, Phase I, Site Options Study as follows:

TABLE 8.3.5-1

SUMMARY OF CONVENTIONAL POLLUTANT LOADINGS
(1000 lbs/day)

	1990	2000	2010	2020
BOD (1000 lb/day)				
Average Day	505	537	554	570
Maximum Day	1010	1074	1108	1140
Maximum Day with Storm	1175	1239	1273	1305
Maximum Three Days	758	806	831	855
Maximum Month	657	698	720	741
TSS (1000 lb/day)				
Average Day	450	481	498	515
Maximum Day	945	1010	1046	1080
Maximum Day with Storm	1345	1410	1446	1480
Maximum Three Days	720	770	797	824
Maximum Month	585	625	647	670

	Non-Storm Peaking Factors BOD	TSS
Maximum Day	2.0	2.1
Maximum Three Days	1.5	1.6
Maximum Thirty Days	1.3	1.3

These peaking factors are typical of large municipal wastewater treatment facilities and are considered representative of nonstorm conditions in both the North and the South Systems.

Maximum day with storm includes allowances for stormwater loads to the plant. There is no correlation between plant flow and load, therefore the pollutant loading from stormwater may be carried with an average flow of a few hundred mgd or with a flow of 960 mgd as discussed in Section 8.2.5. For the purpose of quantifying loadings to the plant, the maximum quantity of stormwater BOD (165,000 lb/day) and TSS (400,000 lb/day) load is shown for each storm event.

8.3.6 WASTEWATER CHARACTERIZATION

The results of the Fall 1986 and Spring 1987 sampling programs were used to determine the general character of the MWRA wastewaters. Characterization parameters for Deer Island, Nut Island, and combined Deer Island and Nut Island flows are presented in Table 8.3.6-1. Parameters for typical domestic wastewaters are also presented.

The Deer Island and Nut Island wastewaters are essentially identical in organic characteristics and both are typically domestic in nature. The wastewaters are highly biodegradable and sufficient nutrients are present in the raw wastewaters for biological treatment.

8.4 NON-CONVENTIONAL POLLUTANT LOADINGS

8.4.1 GENERAL

Non-conventional pollutants are those constituents which can be toxic when found in excessive concentrations. They include heavy metals, volatile organics, pesticides and a suite of other materials. These non-conventional pollutants are classified under the EPA's Priority Pollutant List (PPL) and the Hazardous Substances List (HSL). The PPL and the HSL cover metals as well as organics. For the most part, the HSL parameters overlay those found in the PPL, with some exceptions. The chemical categories within these classifications include metals, acids and base neutral organics, volatile organics, pesticides and PCBs.

Non-conventional pollutants have been evaluated in this study because of their potential adverse impact when released into the environment as part of plant effluent, sludges or air emissions.

TABLE 8.3.6-1

WASTEWATER CHARACTERIZATION

	DEER ISLAND	NUT ISLAND	COMBINED FLOWS	TYPICAL DOMESTIC WASTEWATER
BOD/COD	0.67	0.73	0.69	0.40 - 0.70
BOD/TSS	1.15	0.95	1.08	1.00
TVSS/TSS	0.77	0.76	0.77	0.68 - 0.80
BOD/TKN	7.57	8.39	7.83	4.0 - 7.0
BOD/P	43.5	38.6	45.0	20.0
BOD RATE COEFFICIENT - BASE 10	0.11	0.12	-----	0.10 - 0.13
BOD_5 / BOD_u	0.72	0.77	-----	0.70 - 0.80

Secondary treatment removes some, but not all, non-conventional pollutants from the wastewater. Therefore, a fraction of the non-conventional pollutants pass through the system and into the receiving water. The EPA has developed a series of water quality criteria known as the "Gold Book Criteria" which specify the acceptable levels of these constituents in receiving waters. The results of the following waste characterization studies will be used, along with studies of removal efficiencies and circulation, in the outfall siting studies to assess the potential impacts of the MWRA on compliance with the water quality criteria.

Some pollutants which are removed during the treatment processes become part of the residual from the plant. Residuals management options can be limited by the concentration of non-conventional pollutants. Both EPA and DEQE have regulations limiting the amounts of certain non-conventional pollutants allowed in conjunction with different residuals management options. These issues will be explored as part of the Residuals Management Facilities Plan.

The emission of volatile organics to the air during treatment must also be considered. EPA and DEQE have regulations to guide the evaluations of the emission of contaminants to the air. This topic is discussed in the treatment plant studies, Volume III, Wastewater Treatment Plant.

In order to characterize the parameters described by these three sets of guidelines, sampling of the waste was conducted in the fall of 1986 and spring of 1987, including analyses of chemicals in the PPL and HSL directories. It should be noted that the study undertaken herein is a broad characterization of these pollutants and future detailed studies related to each specific guideline, e.g., Gold Book Criteria, will be conducted as required as part of the outfall siting or Residuals Management Facilities Plan.

In this report, non-conventional pollutants are reported in the same categories as defined in the PPL and HSL directives, namely, metals including cyanide, acid and base neutral (ABN) organics, pesticides and PCBs, and volatile organics (VOAs).

Summary of Sampling Program

A wastewater sampling program was conducted during two seasons: fall of 1986 and spring of 1987. During 1986, samples were collected primarily at the headworks to Deer Island with some samples collected at Deer Island and at the Nut Island influent. During 1987, samples were collected at only the Deer Island and Nut Island influents. (For more information regarding the sampling program, refer to Appendix B of Volume III.) A summary of the results of the sampling program describing the number of samples and frequency of detection for metals, ABNs, pesticides and PCBs, and VOAs is shown in Tables 8.4.1-1 through 8.4.1-4 respectively. It should be noted that the large number of samples in the Fall program reflects the fact that the sampling was performed at each of four headworks rather than at the plant influent only.

The sampling program included collection at the headworks for Deer Island, at the Deer Island and Nut Island Influents, at the Nut Island and Deer Island effluents and some limited sludge sampling. However, for the purposes of characterizing current waste loads and predicting

TABLE 8.4.1-1

SUMMARY OF SAMPLING PROGRAM RESULTS

<———————— TOTAL METALS ————————>

Constituent	Fall Program: Number of Samples	Fall Program: Frequency of Detection: Number	Fall Program: Frequency of Detection: Percent	Fall Program: Detection Limit (ug/L) [1]	Spring Program: Number of Samples	Spring Program: Frequency of Detection: Number	Spring Program: Frequency of Detection: Percent	Spring Program: Detection Limit (ug/L) [1]
ANTIMONY	40	0	0%	25	16	3	19%	2
ARSENIC	40	0	0%	10	19	13	68%	1
BERYLLIUM	40	0	0%	20	16	0	0%	1
BORON	40	5	13%	200	16	16	100%	50
CADMIUM	40	1	3%	5	19	12	63%	1
CHROMIUM	40	40	100%	5	19	19	100%	1
COPPER	40	38	95%	50	19	19	100%	1
CYANIDE, TOTAL	36	2	6%	20 or 40	16	2	13%	10
LEAD	40	36	90%	5	19	15	79%	5
MERCURY	40	8	20%	1	16	12	75%	0.5
MOLYBDENUM	40	0	0%	50 or 100	16	14	88%	1
NICKEL	40	16	40%	20	19	19	100%	2
SELENIUM	40	2	5%	10	16	0	0%	4
SILVER	40	9	23%	5	19	16	84%	2
THALLIUM	40	0	0%	10	16	0	0%	2
ZINC	40	40	100%	2	19	19	100%	4

NOT DETECTED — Metals

BERYLLIUM
THALLIUM
HEX. CHROMIUM

NOTE:

[1] Detection limits were lowered for the Spring sampling program to reflect comparisons to EPA Water Quality Criteria.

TABLE 8.4.1-2

SUMMARY OF SAMPLING PROGRAM RESULTS

<——————— TOTAL ACID AND BASE NEUTRALS ———————>

Constituent	Fall Program: Number of Samples	Fall Program: Frequency of Detection Number	Fall Program: Frequency of Detection Percent	Fall Program: Detection Limit Range (ug/L)	Spring Program: Number of Samples	Spring Program: Frequency of Detection Number	Spring Program: Frequency of Detection Percent	Spring Program: Detection Limit Range (ug/L)
Phenol	21	15	71%	20 - 28	6	1	17%	20 - 27
Benzyl Alcohol	21	13	62%	20 - 28	6	0	0%	20 - 27
1,2-Dichlorobenzene	21	3	14%	20 - 28	6	0	0%	20 - 27
2-Methylphenol	21	2	10%	20 - 28	6	0	0%	20 - 27
4-Methylphenol	21	17	81%	20 - 28	6	3	50%	20 - 27
Benzoic Acid	21	16	76%	100 - 140	6	1	17%	100 - 130
Naphthalene	21	14	67%	20 - 28	6	1	17%	20 - 27
2-Methylnaphthalene	21	16	76%	20 - 28	6	1	17%	20 - 27
2,4,5-Trichlorophenol	21	1	5%	100 - 140	6	0	0%	100 - 130
Dimethyl Phthalate	21	1	5%	20 - 28	6	1	17%	20 - 27
Diethyl Phthalate	21	3	14%	20 - 28	6	1	17%	20 - 27
N-Nitrosodiphenylamine (1)	21	1	5%	20 - 28 20 - 28	6	0	0%	20 - 27
Di-n-butyl Phthalate	21	4	19%	20 - 28	6	1	17%	20 - 27
Butylbenzyl Phthalate	21	5	24%	20 - 28	6	2	33%	20 - 27
Bis(2-ethylhexyl)Phthalate	21	20	95%	20 - 28 20 - 28	6	6	100%	20 - 27
Di-n-octyl Phthalate	21	3	14%	20 - 28	6	2	33%	20 - 27

NOT DETECTED — Acid and Base Neutrals

Bis (2-Chloroethyl)ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4 Dichlorobenzene
Bis(2-Chloroisopropyl)ether
N-Nitro-Dipropylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Bis(2-Chloroethoxy)methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Acenaphthylene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
2,6-Dinitrotoluene
4-Chlorophenyl Phenyl Ether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Bromophenyl Phenyl Ether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Fluoranthene
Pyrene
3,3'-Dichlorobenzidine
Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene
1,2,3,4-Tetrachlorobenzene

TABLE 8.4.1-3

SUMMARY OF SAMPLING PROGRAM RESULTS

<———————————— TOTAL PESTICIDES AND PCBS ————————————>

Constituent	Fall Program Number of Samples	Fall Program Frequency of Detection Number	Fall Program Frequency of Detection Percent	Fall Program Detection Limit (ug/L)	Spring Program Number of Samples	Spring Program Frequency of Detection Number	Spring Program Frequency of Detection Percent	Spring Program Detection Limit Range (ug/L)
ALPHA-BHC	17	0	0%	0.05	6	0	0%	0.05 - 1
BETA-BHC	17	0	0%	0.05	6	0	0%	0.05 - 1
DELTA-BHC	17	0	0%	0.05	6	0	0%	0.05 - 1
					6	0		
GAMMA-BHC	17	0	0%	0.05	6	0	0%	0.05 - 1
HEPTACHLOR	17	0	0%	0.05	6	0	0%	0.05 - 1
ALDRIN	17	0	0%	0.05	6	0	0%	0.05 - 1
					6	0		
HEPTACHLOR EPOXIDE	17	0	0%	0.05	6	0	0%	0.05 - 1
ENDOSULFAN I	17	0	0%	0.05	6	0	0%	0.05 - 1
DIELDRIN	17	0	0%	0.10	6	0	0%	0.10 - 2
					6	0		
4,4'-DDE	17	0	0%	0.10	6	0	0%	0.10 - 2
ENDRIN	17	0	0%	0.10	6	0	0%	0.10 - 2
ENDOSULFAN II	17	0	0%	0.10	6	0	0%	0.10 - 2
					6	0		
4,4'-DDD	17	0	0%	0.10	6	0	0%	0.10 - 2
ENDOSULFAN SULFATE	17	0	0%	0.10	6	0	0%	0.10 - 2
4,4'-DDT	17	0	0%	0.10	6	0	0%	0.10 - 2
					6	0		
ENDRIN KETONE	17	0	0%	0.10	6	0	0%	0.10 - 2
METHOXYCHLOR	17	0	0%	0.50	6	0	0%	0.50 - 10
CHLORDANE (TECHNICAL)	17	0	0%	0.50	6	0	0%	0.50 - 10
					6	0		
TOXAPHENE	17	0	0%	1.	6	0	0%	1 - 2
AROCLOR-1016	17	0	0%	0.50	6	0	0%	0.50 - 10
AROCLOR-1221	17	0	0%	0.50	6	0	0%	0.50 - 10
					6	0		
AROCLOR-1232	17	0	0%	0.50	6	0	0%	0.50 - 10
AROCLOR-1242	17	0	0%	0.50	6	0	0%	0.50 - 10
AROCLOR-1248	17	0	0%	0.50	6	0	0%	0.50 - 10
					6	0		
AROCLOR-1254	17	0	0%	1.	6	0	0%	1 - 20
AROCLOR-1260	17	0	0%	1.	6	0	0%	1 - 20

Note: All the Pesticides and PCBs that were tested for are listed above. None were detected.

TABLE 8.4.1-4

SUMMARY OF SAMPLING PROGRAM RESULTS

<———————— TOTAL VOLATILES ————————>

Constituent	Fall Program: Number of Samples	Fall Program: Frequency of Detection Number	Fall Program: Frequency of Detection Percent	Fall Program: Detection Limit Range (ug/L)	Spring Program: Number of Samples	Spring Program: Frequency of Detection Number	Spring Program: Frequency of Detection Percent	Spring Program: Detection Limit (ug/L)
Bromomethane	108	0	0%	10 - 25	16	12	75%	10
Methylene Chloride	108	44	41%	12 - 12	16	16	100%	5
Acetone	108	39	36%	25 - 25	16	16	100%	5
Carbon Disulfide	108	2	2%	5 - 12	16	9	56%	5
trans-1,2-Dichloroethene	108	19	18%	5 - 12	16	13	81%	5
Chloroform	108	23	21%	5	16	16	100%	5
2-Butanone	108	4	4%	10 - 25	16	14	88%	5
1,1,1-Trichloroethane	108	26	24%	5 - 12	16	16	100%	5
Trichloroethene	108	24	22%	5 - 12	16	16	100%	5
Benzene	108	16	15%	5	16	16	100%	5
4-Methyl-2-Pentanone	108	2	2%	10 - 25	16	0	0%	10
Tetrachloroethene	108	36	33%	5 - 12	16	16	100%	5
1,1,2,2-Tetrachloroethane	108	4	4%	5 - 12	16	0	0%	5
Toluene	108	76	70%	5	16	16	100%	5
Chlorobenzene	108	0	0%	5 - 12	16	3	19%	5
Ethylbenzene	108	18	17%	5 - 12	16	14	88%	5
Styrene	108	3	3%	5 - 12	16	6	38%	5
Total Xylene; M, O, and P	108	50	46%	5 - 12	16	16	100%	5

Not Detected VOLATILE COMPOUNDS

Chloromethane	1,2-Dichloropropane
Vinyl Chloride	trans-1,3-Dichloropropene
Chloroethane	Dibromochloromethane
1,1-Dichloroethene	1,1,2-Trichloroethane
1,1-Dichloroethane	cis-1,3-Dichloropropene
1,2-Dichloroethane	2-Chloroethylvinylether
Carbon Tetrachloride	Bromoform
Vinyl Acetate	2-Hexanone
Bromodichloromethane	

future waste loads, only the influent values were considered.

To characterize the metals loads to the proposed treatment plant, influent samples were collected for six days in the fall and nine days in the spring. For ABNs, samples were collected for 6 days in the fall and three days in the spring. Pesticide and PCB samples were collected on five days in the fall and on three days in the spring while, for VOCs, eight Fall samples and three spring samples were collected.

The following sections discuss the actual results of the sampling programs and the predicted future loads.

Prediction Of Future Loads

In this document, the future wasteloads of non-conventional pollutants are estimated to be the same as the current wasteloads. In actuality, as a result of the industrial pretreatment program to be undertaken by the MWRA, future wasteloads will be lower than current loads. However, since the results of the pretreatment program cannot be predicted adequately at this time, the current loads are used here as a conservative estimate of future loads. It should be noted that increased future flows have been reflected in these estimates. An analysis will be performed as part of the Residuals Management Facilities Plan to determine the impact of lower sludge metals concentrations on sludge management options resulting from the pretreatment program.

8.4.2 METALS

The purpose of this section is to set forth conclusions regarding the characterization of metal loadings for the Nut Island and Deer Island treatment plants.

This section discusses the results of recent sampling programs for metals, the increase in metal loadings that are expected to result from increased wastewater flows, and the potential impact of increased capture of stormwater runoff through a combined sewer overflow control program.

The estimated average mass loading and associated standard deviations are shown for constituents which were detected at least once during either testing program. The average mass is the sum of the average of the total pounds of pollutant found at Nut and Deer Island. The total pounds of pollutant for each day is based on the concentration measured in each sample and flow readings that were recorded on the day of the sample. In a number of cases, the concentrations were reported from the laboratory as below the detection limit (BDL) of the test method. In these instances, the following procedure was followed:

- for spring samples (which generally had the lowest detection limits), the detection limit was used as the concentration.

- for fall samples, the fall detection limit was used if the spring sampling indicated that the loading was at or above the fall detection limit since one could not be assured that the results would fall between the two detection limits or below the spring limit. If the spring sampling indicated that the concentration would have been below the fall detection limits, the sample was not used in the analysis.

A summary of the existing metal loadings is shown in Table 8.4.2-1. For three metals, beryllium, thallium and hexavalent chromium (spring samples only), concentrations were always below the detection limit. In these cases no average loading is presented.

Metal Loads in the Future

For the purpose of estimating future mass loading that results from increases in wastewater flows, the metal loads have been increased in the same ratio as the increase in wastewater flows. If it is assumed that wastewater (as distinguished from infiltration/inflow) will increase from an average annual flow of 208 mgd to 239 mgd in the future, then the total metal loading would increase by the same percentage (15 %) over the same period of time. This approach assumes that future wastewater characteristics will be very similar to current characteristics.

The only significant change in system operation that will affect metal loadings is the increased capture of combined sewer overflows. As new stormwater retention facilities are completed, combined sewer overflows will be reduced. This will increase the plant loadings for metals. Quantifying the increase in loadings that will result from CSO capture is a complex problem.

Estimates of metal loadings from the Fall Sampling Program are considered dry weather loads because sampling occurred during periods of dry weather. For this reason these loadings include all pollutants from domestic, commercial and industrial activities. Therefore, the increased loads resulting from CSO capture equals the loadings from stormwater runoff.

To estimate the quality of stormwater, runoff information from EPA's Nationwide Urban Runoff Program (NURP) was used. Stormwater runoff metals quality from the NURP is summarized in Table 8.4.2-1. The values selected as estimates of urban stormwater quality in the MWRA service area were not subject to any special statistical analyses, but were selected as being representative of the range of observed CSO values.

Mass loadings of pollutant metals resulting from CSO capture are based on the selected values presented in Table 8.4.2-2. The average annual return of stormwater runoff from CSO capture is estimated to be 20 MGD. This 20 MGD represents 100% capture of runoff on an annual basis. Where no NURP value was chosen for a pollutant, the estimated loadings were based on the percentage of increased CSO capture to existing flow (20/208 = 15%).

TABLE 8.4.2-1

EXISTING METAL LOADINGS

Constituent	Average Load (Lbs/Day)	Standard Deviation (Lbs/Day)
ANTIMONY	10.8	2.3
ARSENIC	6.0	1.9
BORON	1261.2	2443.4
CADMIUM	7.1	2.7
CHROMIUM	75.8	29.5
COPPER	345.1	103.4
CYANIDE, TOTAL	53.9	13.9
LEAD	49.9	21.8
MERCURY	4.1	5.2
MOLYBDENUM	17.1	10.4
NICKEL	66.0	29.5
SELENIUM	35.2	33.2
SILVER	15.5	3.8
ZINC	738.8	841.8

NOTE: Average Load represents the non-storm mean load at Deer Island plus the non-storm mean load at Nut Island. Loadings are based on influent values only, which are reported in Summary Memorandum FB20C, and are the result of sample collections at the headworks for Deer Island, and Deer and Nut Island Influents.

TABLE 8.4.2-2

RUNOFF QUALITY — METALS

Constituent	Frequency of Detection [1]	Range of Observed Values [1]	Estimated Range of Mean Values [1]	Selected Value [2]
		(ug/L)	(ug/L)	(ug/L)
ANTIMONY	13%	2.6-23		23.0
ARSENIC	52%	1-50	1.6-4.3	4.3
BORON	Not Done			NA
CADMIUM	48%	1-14	.6-1.6	1.6
CHROMIUM	58%	1-190	3.1-8.5	8.5
COPPER	91%	1-100	17.9-19.5	19.5
CYANIDE, TOTAL	23%	2-300		300.0
LEAD	94%	6-460	65.6-72.8	72.8
MERCURY	9%	0.6-1.2		1.2
MOLYBDENUM	Not Done			NA
NICKEL	43%	1-182	5.8-19.1	19.1
SELENIUM	11%	2-77		77.0
SILVER	7%	0.2-0.8		0.8
ZINC	94%	10-2400	92.3-103.7	103.7

Notes: [1] The data is taken from the EPA's National Urban Runoff Program study.

[2] The selected value is the upper confidence interval of the geometric mean of pollutants detected more that 20% of the time, or the maximum observed value, where a estimated mean value does not exist.

Summary of Future Metal Loads

Aggregate future metal loads were computed based on an existing load, and increases from new wastewater and capture of urban runoff. The results of these computations are shown in Table 8.4.2-3. These are annual average loadings, and are subject to day-to-day variability.

8.4.3 ACID BASE NEUTRALS

This section describes the characterization of acid and base-neutral (ABN) loadings for the Nut Island and Deer Island Treatment Plants. The ABN terminology arises from the analytical methods used to quantify these organic compounds. The methods use either an acid or base-neutral extraction in the procedure. In the aggregate, there are 66 organic chemicals classified under the PPL and HSL, which comprise the ABN fractions.

Fall and Spring Sampling Program Results

Estimates of the existing average mass and standard deviations of the detected ABN compounds are shown on Table 8.4.3-1. As was done with the metals fractions, the average mass is based on the observed flows on the day of sampling, as well as the observed concentrations, while test results which were below the analytical detection limit were replaced with the detection limit.

ABN Loads in the Future

Increases in future loadings of the ABN fraction were also computed in a manner comparable to that used for metals. Increases in future loadings attributable to increases in wastewater flow (as distinguished from infiltration and inflow) were taken as the prorata increase in flow.

Increases in loadings of ABNs associated with improved CSO management practices have been estimated based on the estimated average runoff volume of 50 mgd and concentrations of ABNs in urban runoff. Data from EPA's NURP Program were used to select a value for runoff quality for those compounds which were detected in the wastewater sampling. Information concerning the compounds, their frequencies of detection and ranges of concentrations are presented in Table 8.4.3-2.

For the purpose of estimating runoff loads, the highest observed values were used. If the constituent was not analyzed as part of the NURP program, the existing load was incremented by the ratio of the projected runoff flow to the wastewater flow.

Summary of Future ABN Loads

Aggregate future ABN loadings were computed based on the existing loads, increases from new wastewater generated in the service area, and capture of urban runoff. The results of these

TABLE 8.4.2-3

FUTURE METAL LOADINGS

Constituent	Existing Average Mass Loadings	Flow Related Increase [1]	Projected Non-Runoff Average Mass Loadings [2]	Runoff Loadings Increase [3]	Projected Total Average Mas Loadings [4]
	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)
ANTIMONY	10.8	1.6	12.4	3.8	16.2
ARSENIC	6.0	0.9	6.9	0.7	7.6
BORON	1261.2	188.0	1449.2	121.3	1570.5
CADMIUM	7.1	1.1	8.2	0.3	8.4
CHROMIUM	75.8	11.3	87.1	1.4	88.5
COPPER	345.1	51.4	396.5	3.3	399.8
CYANIDE, TOTAL	53.9	8.0	61.9	50.0	112.0
LEAD	49.9	7.4	57.3	12.1	69.5
MERCURY	4.1	0.6	4.8	0.2	5.0
MOLYBDENUM	17.1	2.6	19.7	1.6	21.3
NICKEL	66.0	9.8	75.9	3.2	79.1
SELENIUM	35.2	5.2	40.4	12.8	53.3
SILVER	15.5	2.3	17.8	0.1	18.0
ZINC	738.8	110.1	848.9	17.3	866.2

Notes: [1] Wastewater incremented in proportion to increases in wastewater discharges. Average daily flow is projected to increase from 208 MGD to 239 MGD.

[2] The Projected Non-Runoff Average Mass Loading is the sum of the Existing Average Mass Loading and the Flow Related Increase.

[3] The Increase from the Runoff Loading is based on either the:

a) avg. daily runoff return flow equal to 20 MGD and concentrations taken from the "Selected" column of TABLE 8.4.2-2, or

b) avg. daily runoff return flow equal to 20 MGD and concentrations taken from the existing average mass loading with flow equal to 208 MGD.

TABLE 8.4.3-1

EXISTING ABN LOADINGS

Constituent	Average Load (Lbs/Day)	Standard Deviation (Lbs/Day)
Phenol	54.0	27.1
Benzyl Alcohol	69.3	24.7
1,2-Dichlorobenzene	65.1	23.3
2-Methylphenol	71.0	18.3
4-Methylphenol	61.2	23.2
Benzoic Acid	269.4	138.9
Naphthalene	45.3	28.4
2-Methylnaphthalene	49.6	26.7
2,4,5-Trichlorophenol	349.0	95.8
Dimethyl Phthalate	69.6	19.4
Diethyl Phthalate	57.1	24.5
N-Nitrosodiphenylamine (1)	69.3	19.7
Di-n-butyl Phthalate	57.9	25.9
Butylbenzyl Phthalate	54.0	24.1
Bis(2-ethylhexyl)Phthalate	67.8	20.0
Di-n-octyl Phthalate	57.0	21.4

NOTE: Average Load represents the non-storm mean load at Deer Island plus the non-storm mean load at Nut Island. Loadings are based on influent values only, which are reported in Summary Memorandum FB20C, and are the result of sample collections at the headworks for Deer Island and Deer and Nut Island Influents.

TABLE 8.4.3-2

RUNOFF QUALITY — ABNS

Constituent	Frequency of Detection	Range of Values (ug/L)	Selected Value (ug/L)
Phenol	14%	1 - 13	13.0
Benzyl Alcohol	Not Done	NA	NA
1,2-Dichlorobenzene	0%	0	0.0
2-Methylphenol	Not Done	NA	NA
4-Methylphenol	Not Done	NA	NA
Benzoic Acid	Not Done	NA	NA
Naphthalene	9%	0.8 - 2.3	2.3
2-Methylnaphthalene	Not Done	NA	NA
2,4,5-Trichlorophenol	Not Detected	0	0.0
Dimethyl Phthalate	1%	1	1.0
Diethyl Phthalate	6%	1 - 10	10.0
N-Nitrosodiphenylamine (1)	Not Done	NA	NA
Di-n-butyl Phthalate	6%	0.5 - 11	11.0
Butylbenzyl Phthalate	6%	1 - 10	10.0
Bis(2-ethylhexyl)Phthalate	22%	0.4 - 2	2.0
Di-n-octyl Phthalate	6%	0.5 - 2	2.0

computations are shown in Table 8.4.3.-3. These are subject to day-to-day variability.

8.4.4 PESTICIDES AND PCBs

Fall and Spring Sampling Program Results

Since no pesticides or PCBs were found in this sampling, specific projects may have to be implemented to investigate these compounds further.

These should include an evaluation of sludge in conjunction with wastewater sampling. Interpolation of PCBs and pesticides in the sludge to a projected influent can be made. However, at this time sufficient data is not available to calculate these values.

8.4.5 VOLATILE ORGANIC COMPOUNDS

Unlike the other constituents, where composite samples were always taken from the influent to the Nut and Deer Island plants, the volatile sampling differed in the following respects:

- The analytical protocols require that grab samples be used. In this program, grab samples were taken every six hours.
- During the Fall program, samples of the Deer Island influent were not taken. Rather, samples were taken at each of the four headworks. The results of these were combined to produce an estimate of the Deer Island load.

Fall and Spring Sampling Program Results

Estimates of the existing average mass and standard deviations of the detected volatile compounds are shown on Table 8.4.5-1. As was done with the metals fractions, the average mass is based on the observed flows and observed concentrations at the time of sampling, while test results which were below the analytical detection limit were replaced with the detection limit.

Volatile Organics Loads in the Future

Increases in future loadings of the volatile fraction were also computed in a manner comparable to that used for metals and ABNs. Increases in loadings of volatiles associated with improved CSO management practices have been estimated based on the estimated average runoff volume of 50 mgd and the concentrations of volatiles in urban runoff. Data from EPA's NURP Program were used to select a value for runoff quality for those compounds which were detected in the wastewater sampling. Information concerning the compounds, their frequencies of detection, and ranges of concentrations are presented in Table 8.4.5-2. For the purpose of estimating runoff loads, the highest observed values were used. If the constituent was not analyzed as part of the NURP program, the existing load was incremented by the ratio of the projected runoff flow to the wastewater flow.

TABLE 8.4.3-3

FUTURE ABN LOADINGS

Constituent	Existing Average Mas Loadings	Flow Related Increase [1]	Projected Non-Runoff Average Mas Loadings [2]	Runoff Loadings Increase [3]	Projected Total Average Mass Loadings [4]
	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)
Phenol	54.0	8.0	62.1	2.2	64.2
Benzyl Alcohol	69.3	10.3	79.7	6.7	86.3
1,2-Dichlorobenzene	65.1	9.7	74.8	0.0	74.8
2-Methylphenol	71.0	10.6	81.5	6.8	88.4
4-Methylphenol	61.2	9.1	70.4	5.9	76.3
Benzoic Acid	269.4	40.2	309.6	25.9	335.5
Naphthalene	45.3	6.8	52.1	0.4	52.5
2-Methylnaphthalene	49.6	7.4	57.0	4.8	61.8
2,4,5-Trichlorophenol	349.0	52.0	401.0	0.0	401.0
Dimethyl Phthalate	69.6	10.4	80.0	0.2	80.2
Diethyl Phthalate	57.1	8,5	65.6	1.7	67.3
N-Nitrosodiphenylamine (1)	69.3	10.3	79.6	6.7	86.3
Di-n-butyl Phthalate	57.9	8.6	66.5	1.8	68.4
Butylbenzyl Phthalate	54.0	8.0	62.0	1.7	63.7
Bis(2-ethylhexyl)Phthalate	67.8	10.1	77.9	0.3	78.3
Di-n-octyl Phthalate	57.0	8.5	65.5	0.3	65.8

Notes: [1] Wastewater incremented in proportion to increases in wastewater discharges. Average daily flow is projected to increase from 208 MGD to 239 MGD.

[2] The Projected Non-Runoff Average Mass Loading is the sum of the Existing Average Mass Loading and the Flow Related Increase.

[3] Storm flow loads are based on either the:
a) avg. daily runoff return flow equal to 20 MGD and concentrations taken from the "Selected" column of TABLE 8.4.3-2, or
b) avg. daily runoff return flow equal to 20 MGD and concentrations taken from the existing average mass loading with flow equal to 208 MGD.

[4] The Projected Total Average Mass Loading is the sum of the Projected Non-Runoff Average Mass Loadings and the Runoff Loadings Increase.

TABLE 8.4.5-1

EXISTING VOLATILE LOADINGS

Constituent	Average Load (Lbs/Day)	Standard Deviation (Lbs/Day)
Bromomethane	54.3	19.3
Methylene Chloride	104.7	75.3
Acetone	337.1	268.6
Carbon Disulfide	27.5	7.6
trans-1,2-Dichloroethene	25.6	7.8
Chloroform	17.6	8.1
2-Butanone	82.5	43.8
1,1,1-Trichloroethane	41.8	17.9
Trichloroethene	36.2	19.2
Benzene	12.5	2.3
4-Methyl-2-Pentanone	64.7	23.7
Tetrachloroethene	47.4	27.8
1,1,2,2-Tetrachloroethane	29.4	6.4
Toluene	60.8	38.1
Chlorobenzene	28.0	7.6
Ethylbenzene	28.8	13.0
Styrene	30.1	7.3
Total Xylene; M, O, and P	85.9	59.4

NOTE: Average Load represents the non-storm mean load at Deer Island plus the non-storm mean load at Nut Island. Loadings are based on influent values only, which are reported in Summary Memorandum FB20C, and are the result of sample collections at the headworks for Deer Island and Deer and Nut Island Influents.

TABLE 8.4.5-2

RUNOFF QUALITY — VOLATILES

Constituent	Frequency of Detection	Range of Values (ug/L)	Selected Value (ug/L)
Bromomethane	Not Detected	0	0.0
Methylene Chloride	Not Detected	0	0.0
Acetone	Not Done	NA	NA
Carbon Disulfide	Not Done	NA	NA
trans-1,2-Dichloroethene	4%	1 - 3	3.0
Chloroform	9%	0.2 - 12	12.0
2-Butanone	Not Done	NA	NA
1,1,1-Trichloroethane	6%	1.6 - 10	10.0
Trichloroethene	6%	0.3 - 12	12.0
Benzene	5%	1 - 13	13.0
4-Methyl-2-Pentanone	Not Done	NA	NA
Tetrachloroethene	5%	1 - 43	43.0
1,1,2,2-Tetrachloroethane	4%	2 - 3	3.0
Toluene	3%	3 - 9	9.0
Chlorobenzene	5%	1 - 10	10.0
Ethylbenzene	6%	1 - 2	2.0
Styrene	Not Done	NA	NA
Total Xylene; M, O, and P	Not Done	NA	NA

TABLE 8.4.5-3

FUTURE VOLATILE LOADINGS

Constituent	Existing Average Mass Loadings	Flow Related Increase [1]	Projected Non-Runoff Average Mas Loadings [2]	Runoff Loadings Increase [3]	Projected Total Average Mass Loadings [4]
	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)	(Lbs/Day)
Bromomethane	54.3	8.1	62.3	0.0	62.3
Methylene Chloride	104.7	15.6	120.3	0.0	120.3
Acetone	337.1	50.2	387.3	32.4	419.7
Carbon Disulfide	27.5	4.1	31.6	2.6	34.3
trans-1,2-Dichloroethene	25.6	3.8	29.4	0.5	29.9
Chloroform	17.6	2.6	20.3	2.0	22.3
2-Butanone	82.5	12.3	94.8	7.9	102.8
1,1,1-Trichloroethane	41.8	6.2	48.0	1.7	49.7
Trichloroethene	36.2	5.4	41.6	2.0	43.6
Benzene	12.5	1.9	14.3	2.2	16.5
4-Methyl-2-Pentanone	64.7	9.6	74.3	6.2	80.5
Tetrachloroethene	47.4	7.1	54.5	7.2	61.7
1,1,2,2-Tetrachloroethane	29.4	4.4	33.8	0.5	34.3
Toluene	60.8	9.1	69.8	1.5	71.3
Chlorobenzene	28.0	4.2	32.1	1.7	33.8
Ethylbenzene	28.8	4.3	33.1	0.3	33.4
Styrene	30.1	4.5	34.6	2.9	37.5
Total Xylene; M, O, and P	85.9	12.8	98.7	8.3	107.0

Notes: [1] Wastewater incremented in proportion to increases in wastewater discharges. Average daily flow is projected to increase from 208 MGD to 239 MGD.

[2] The Projected Non-Runoff Average Mass Loading is the sum of the Existing Average Mass Loading and the Flow Related Increase.

[3] Storm flow loads are based on either the:
a) avg. daily runoff return flow equal to 20 MGD and concentrations taken from the "Selected" column of TABLE 8.4.5-2, or
b) avg. daily runoff return flow equal to 20 MGD and concentrations taken from the existing average mass loading with flow equal to 208 MGD.

- On the average day, the capacity of the plant to accept stormwater, either directly or as CSO return flows, will vary from about 600 to 880 mgd depending on the time of the year.

- A sensitivity analysis of flows was performed which indicated that the total flows are most sensitive to the volume of infiltration/inflow entering the system. System management can be structured to compensate for any unanticipated increase in domestic or nondomestic wastewater flow, through reductions in infiltration/inflow.

- Average daily nonstorm loadings of total suspended solids and biochemical oxygen demand are expected to increase about 12 percent to 570,000 lbs/day of BOD and 515, 000 lbs/day of TSS over the planning period. These increased loadings are attributable to increases in wastewater flow. Maximum daily BOD and TSS loadings are expected to be 2.0 and 2.1 times the average, respectively. During storm conditions additional loadings will reach the plant. The total suspended solids loading rate from stormwater will increase the wastewater loadings by approximately 400,000 lbs/day. The biochemical oxygen demand loading rate from stormwater will increase the wastewater loadings by approximately 165,000 lbs/day.

- Nonconventional pollutant loadings (metals, acids and base neutral organics, volatile organics, pesticides and PCBs) to Deer Island will increase in the future in proportion to the increase in future wastewater flow to the plant (approximately 15 percent) and the degree to which combined sewer overflows are captured. For selected nonconventional pollutants the CSO increase ranges from a few percent to up to 25 percent compared to existing loadings, assuming that all CSOs are captured and returned to the plant.

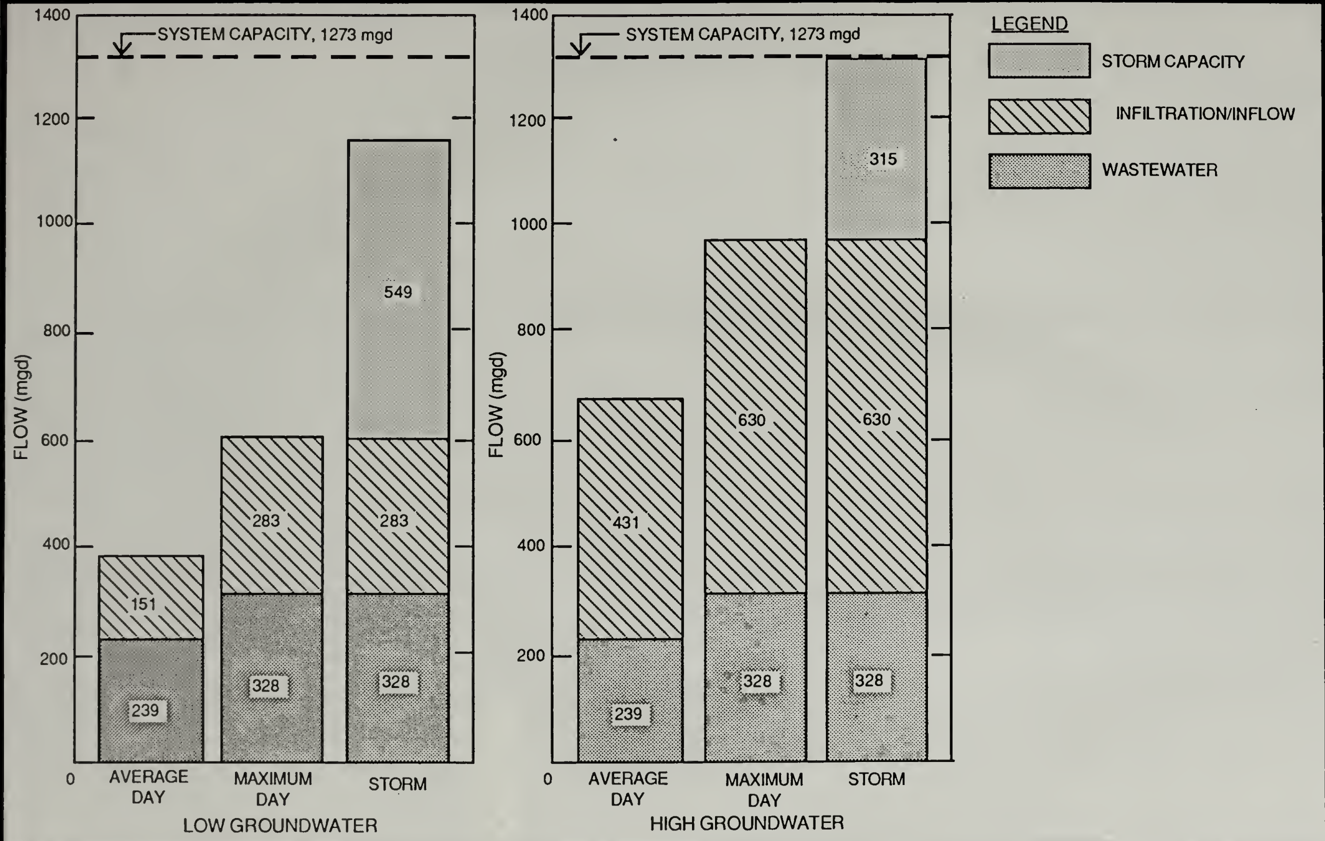
A summary of the projected flows (rounded to the nearest 10 mgd) and loadings is presented in Table 8.5-1. Figure 8.5-1 summarizes the design year flow, by components, for low and high groundwater conditions.

TABLE 8.5-1

SUMMARY OF DESIGN YEAR (2020) FLOWS AND LOADING

	Low Groundwater Conditions		High Groundwater Conditions	
	Average Day	Maximum Day	Average Day	Maximum Day
Non-Storm Conditions				
Total Wastewater (mgd)	390	600	670	950
BOD (1000 lb/day)	570	1140	570	1140
TSS (1000 lb/day)	515	1080	515	1080
Storm Conditions				
Total Wastewater (mgd)	---	600	---	950
Stormwater (mgd)	---	550	---	320
Total (mgd)	---	1150	---	1270
BOD (1000 lb/day)	---	1305	---	1305
TSS (1000 lb/day)	---	1480	---	1480

(Annual Average Flow is 480 mgd based on 4 months of high groundwater conditions and 8 months of low groundwater conditions)



MASSACHUSETTS WATER RESOURCES AUTHORITY

FIGURE 8.5-1
SUMMARY OF DESIGN YEAR FLOWS

Section 9

9.0 PUBLIC PARTICIPATION SUMMARY

9.1 INTRODUCTION

In facing the monumental tasks associated with the successful implementation of the Deer Island Secondary Treatment Facilities Plan (STFP), the Authority instituted a comprehensive public participation effort. The measures included in this summary were designed to meet federal and state regulatory requirements associated with the project, to satisfy grant conditions, and to provide the most meaningful avenues of public input into the critical decisions to be made by the Authority. Through this program, the Authority's dialogue with the public has been ongoing and important policy decisions have been made and will continue to be made within the context of maximum public knowledge and participation.

9.2 COORDINATION WITH OTHER HARBOR CLEAN-UP PROJECTS

Because the total Harbor clean-up program consists of many simultaneous efforts, the public participation activities associated with the STFP have been closely coordinated with public participation efforts being undertaken for other projects. Public participation coordination has mirrored similar efforts on the technical side, particularly with regard to overlapping concerns. Coordination occurs on several levels:

- Engineering and Public Affairs project staff and technical and public participation consultants for both the Deer Island Secondary Treatment Facilities Plan and Residuals Management Facilities Plan (RMFP) have met at least monthly to discuss coordination efforts and to review schedules and agendas for upcoming meetings.

- The public participation programs are coordinated through the Authority's Public Participation Coordinator and augmented by other Public Affairs staff, including media, intergovernmental and community relations personnel, particularly when project components have a direct bearing on a particular community.

- The Citizens' Advisory Committee (CAC) have served to review work associated with both the Secondary Treatment Facilities Plan and the Residuals Management Facilities Plan and have been kept informed of developments on other projects, such as water transportation, CSOs and the setting of local limits for industrial discharges.

9.3 CITIZENS' ADVISORY COMMITTEE

In July, 1986 the MEPA Unit of EOEA served notice of the formation of a Citizens' Advisory Committee for the STFP in the Environmental Monitor. In addition, notices were mailed to several hundred individuals and organizations and an announcement was placed in On the Waterfront, the MWRA newsletter, which was mailed to over 1500 individuals, groups and agencies.

Pursuant to discussions among agencies, it was decided that this CAC would serve to review both the STFP and the RMFP. Active members of the Authority's informal CAC from Phase I of the RMFP were solicited for nominations to the STFP CAC.

On October 10, 1986, EOEA Secretary James S. Hoyte appointed the CAC, which consists of 28 representatives and 15 alternate members. (See Table 9-1). The CAC consists of representatives of environmental, business, community, government and other interests. In addition, agency representatives are serving in a non-voting capacity.

Technical support from Authority staff and consultants has been provided to assist in interpreting data and reports for the CAC. Administrative support from Authority Public Affairs staff and public participation subconsultants includes preparation of agendas, minutes and CAC reports, and scheduling of meetings and workshops. In addition, funds were allocated in the Authority's Capital Expenditure Budget to cover expenses the CAC may incur.

The CAC has met on a regular monthly basis and has chosen to form subcommittees to examine specific issues. In addition, a workshop on project scoping took place in February, 1986. The subcommittees have met on an as needed basis, generally on the fourth Monday of each month from 4:30 to 6:30 p.m. at a location agreeable to the majority of participants. Sub-group meetings have been scheduled for the early part of each month as needed. Materials are distributed to the CAC at the end of the meeting for discussion at the following month's meeting. At times it has been necessary to distribute these materials through the mail, but sufficient time is allocated for the CAC members to review the information and prepare for the discussion. Agendas, minutes and certain other materials are also distributed prior to the CAC meetings.

9.4 TECHNICAL ADVISORY GROUP

As an adjunct to the public participation program, a technical advisory group has been formed to provide a mechanism for input from involved agencies as well as technical advice and support to the Citizens' Advisory Committee. Representatives of agencies involved in regulatory, permitting, funding or other capacities were solicited by the MEPA Unit of EOEA for membership on the TAG, as were former members of the siting EIS TAG formed under EPA's auspices. A list of those representatives is attached in Table 9-2.

In order to benefit from the Authority's presentations to the CAC and to assist the citizen representatives in understanding technical issues, TAG representatives are invited to attend all CAC meetings and workshops. They are provided with documents in advance of the meetings and are asked to provide written review and comment, to be returned to the Authority in a timely fashion.

With this arrangement, the Authority can benefit from the advice of the TAG without devoting large portions of the CAC's agenda to technical discussions which the citizen representatives may not understand. The TAG is also free to meet on its own or at the request of the agencies, such as the EPA.

9.5 PUBLIC MEETINGS

Public meetings fall into several categories:

A. Forums--In order to clarify the Authority's overall program for interested constituent groups and the public at-large, a forum was held in Boston in January, 1987. At this forum a total picture of the Harbor clean-up effort was presented. Two additional forums are planned for January and May of 1988.

B. Public Information Meetings--Public information meetings have been held at project milestones, including: Outfall Screening and Technology, in March at Lynn and Quincy; and Early Site Preparation, Alternative Site Layouts and recommended Inter-Island alternatives in July in Boston. A public meeting on the status of facilities planning, excluding the outfall work, will take place in September. A public meeting devoted to the status of the outfall study will take place in November at two locations.

C. Meeting with Impacted Communities--In addition to its attempts to educate the CAC and the public at-large, the Public Participation Program addresses the concerns of communities to be impacted by the results of the decisions made during the study. The Authority's Community Relations liaison with the Town of Winthrop has attended monthly meetings of the Town's Representative Citizens Committee to keep them abreast, not only of ongoing operational and fast-track upgrade issues at the existing primary plant, but also of the progress of the Secondary Treatment Facilities Plan.

   The Authority also holds regular public meetings with the Winthrop community at-large to update them on the STFP and to hear public concerns regarding key decisions. Similarly, the Authority's Boston/Quincy Community Relations Coordinator has attended monthly Nut Island CAC meetings. The Community Relations Coordinator for the northern sector of the MWRA service area will provides similar coordination efforts to communities which may be potentially affected by outfall siting decisions.

   Local elected and appointed officials are kept informed of all developments with the STFP relative to their concerns through the Public Participation and Community Relations Coordinators.

D. Other Meetings

There are three Public Hearings scheduled to be held at three locations each: one on Site Preparation background and Inter-Island Conduit; one on Treatment Plant and Institutional Considerations; and one on Outfall. Special request meetings with the MWRA Advisory Board and other groups and organizations have taken place.

E. Responsiveness Summaries

Responsiveness summaries of all public information meetings and public hearings are available within four (4) weeks after the public meeting.

9.6 OTHER INFORMATIONAL ACTIVITIES

The STFP project team has been involved in development of informational materials, including newsletters, public service announcements, press releases, an educational display, brochures, responsiveness summaries, and fact sheets for use at public and CAC meetings, as well as for distribution through mailing lists, repositories, schools, clubs, and other community information centers.

9.7 LIST OF REPOSITORIES

Winthrop Public Library
Attn: George Pillion
2 Metcalf Square
Winthrop, MA 02152
846-1703

Hours of service: Mon., Tues., Thurs. 1-9; Wed. 10-9; Fri. 10-6; Sat. 10-5

Thomas Crane Public Library
Attn: Linda Beeler--Reserve Dept.
40 Washington Street
Quincy, MA 02169
471-2400

Hours of service: Mon.-Thurs. 9-9; Wed. 10-9; Fri. 10-6; Sat. 10-5

Hough's Neck Community Center
Attn: Patricia Redlen
1193 Sea Street
Quincy, MA 02169

Hours of service: Mon. 9-8:30; Tues.-Fri. 9-4

Boston Public Library
Attn: Jennifer Nason
Document Dept./Rm. 341
State House
Boston, MA 02133
727-2590

Hours of service: Mon.-Fri. 9-5

Wellesley Public Library
530 Washington Street
Wellesley, MA 02181

Hours of service: Mon.-Thurs. 10-9; Fri. 10-7; Sat. 9-5; Sun. 2-5

Malden Public Library
Walpole Street
Norwood, MA 02062

Hours of service: Mon.-Fri. 9-9; Sat. 9-5; Sun. 1-5

MWRA Library
Charlestown Navy Yard
100 First Avenue
Boston, MA 02129
242-6000

Hours of service: Mon.-Fri. 8:30-5

(This is a central reference location with full project histories and other information available to CAC members and the public.)

9.8 MAILING LIST

The MWRA's computerized mailing list currently consists of over 2000 individuals, groups and agencies, which fall into the following categories:

- MWRA Advisory Board (local officials)
- Legislators (federal, state, regional, local)
- Media
- Agencies (federal, state, regional, local)
- Groups/Organizations
- Individuals

In addition, issue codes have been assigned to mailing list entries, so the list may be sorted by issue code, zip code, or town. Attendees at public meetings are added to the mailing list.

9.9 PUBLIC PARTICIPATION SCHEDULE

The CAC meeting agenda is reviewed with the chairman and executive committee of the CAC prior to each meeting. The long-term agenda is reviewed with the CAC on a quarterly basis and updated as needed, with their input. For a complete listing of meetings that have taken place and planned meetings, please refer to the Public Participation Schedule (Table 9.3).

TABLE 9-1
SECONDARY TREATMENT FACILITIES PLAN
CITIZENS' ADVISORY COMMITTEE
REPRESENTATIVES AND ALTERNATES

Lois Baxter
17 Circuit Road
Winthrop, MA 02152
Alternate
846-3040 (h)

William Benson
52 Grinnell Street
Greenfield, MA 01301
Representative
(413) 773-5267

Peter Blanchard
Mass. Bankers Association
Prudential Tower, Suite 550
Boston, MA 02199
Representative
542-1837

Mike Bothner
USGS
Quisset Campus
Woods Hole, MA 02543
Alternate
548-8700

Michael Cheney
94 Rock Island Road
Quincy, MA 02169
Alternate
471-1493 (h)

Leonard DeModena
182 Princeton Street
East Boston, MA 02128
Representative
727-1263 (w)

Emilie DiMento
Winthrop Concerned Citizens
118 Woodside Ave.
Winthrop, MA 02152
Representative
826-9406

Mark Doran
Associated Industries of Mass.
462 Boylston Street
Boston, MA 02116
Representative
262-1180

Joe Duggan
Greater Boston Chamber of
Commerce
125 High Street
Boston, MA 02110
Representative
426-1250

Polly Bradley
SWIM
33 Summer Street
Nahant, MA 01908
Representative
581-0075

Brad Butman
USGS
Quisset Campus
Woods Hole, MA 02543
Representative
548-8700

Eugene Canty
2 Lafayette Terrace
Nahant, MA 01908
Alternate
581-0281

Leo Kelly
143 Spring Street
Quincy, MA 02169
Alternate
773-1534

Robert Luongo
Office of Community Development
City Hall, 500 Broadway
Chelsea, MA 02150
Alternate
889-0700

Joseph MacRitchie
110 Sonoma Road
Squantum, MA 02171
Representative
773-1380

William Elliott
2 Bargate Lane
Hadley, MA 01035
Representative
(413) 586-8861

Astrid Glynn
Glynn & Dempsey, P.C.
One Federal Street
Boston, MA 02110
Representative
523-7420

Lydia Goodhue
The Boston Harbor Associates
90 Dover Road
Wellesley, MA 02181
Representative
235-5370

Phillip Goodwin
Mass. Bay Yacht Clubs Assoc.
73 Bicknell Street
Quincy, MA 02169
Representative
471-5913

Alice Hennesey
Boston City Council
One City Hall Plaza
Boston, MA 02201
Alternate
725-4000

Stephen Hunt
Save the Harbor/Save the Bay
3 Joy Street
Boston, MA 02108
Alternate
742-7283

Hiroko Masamune
Sierra Club New England
182 Brookline Street
Newton, MA 02159
Alternate
964-4467 (h)

Tom McNiff
118 Grandview Ave.
Winthrop, MA 02152
Alternate
846-3782

Herbert Meyer
Mystic River Watershed Assoc.
276 Massachusetts Avenue
Arlington, MA 02174
Representative
643-2157

Phil Mitchell
Construction Industries of Mass.
P.O. Box 667
Norwood, MA 02062
Alternate
551-0182

Judith Schlosser
Office of Community Development
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Representative
889-0700 (w)

Eric Thomson
Utility Contractors' Association
150 Wood Road, Suite 305
Braintree, MA 02184

Betsy Johnson
Mass. Audubon - Boston
3 Joy Street
Boston, MA 02108
Representative
367-1026

Ruth Kaminski
25 Moosehill Road
Leicester, MA 01524
Representative
892-3121

Mary Kelley
Winthrop Conservation
Commission
48 Sargent Street
Winthrop, MA 02152
Representative
846-9450

Martin Nee
c/o Rep. M. Flaherty
State House, Room 138
Boston, MA 02133
Representative
722-2396

Robert Noonan
Winthrop Board of Selectmen
Town Hall
Winthrop, MA 02152
Representative
846-1852

Marjorie O'Neil
212 Chestnut Street
Brookline, MA 02146
Alternate
232-6260

Jack Walsh
63 Sea Avenue
Quincy, MA 02169
Representative
471-6191 (h)

Virginia Wilder
Office of Community Development
Town Hall
Winthrop, MA 02152
Alternate
846-1852

Nicholas Yannoni
31 Lafayette Road
Newton, MA 02162
Alternate
377-2206

John Scalcione
36 Frankfort Street
East Boston, MA 02128
Representative
589-3926

Martin Pillsbury
Metro. Area Planning Council
110 Tremont Street
Boston, MA 02108
Representative
451-2770

John Piotti
MWRA Advisory Board
6 Beacon St., Room 925
Boston, MA 02108
Representative
742-7561

Stewart Sanders
Mystic River Watershed Assoc.
73 Fairmont Street
Belmont, MA 02178
Alternate
489-3120

Lawrence Schafer
26 Emerson Street
Newton, MA 02158
Representative
965-9888

TABLE 9-2
SECONDARY TREATMENT FACILITIES PLAN
TECHNICAL ADVISORY GROUP

Karen Adams
US Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02154
TAG
647-8237

Libby Blank
Boston Water and Sewer Commission
10 Post Office Square
Boston, MA 02109
TAG
426-6046

Lt. Commander Peter Blaisdell
U.S. Coast Guard, Marine Safety Div.
408 Atlantic Avenue
Boston, MA 02110
TAG
223-8441 (Douglas Brown)

Roberta Ellis
MASSPORT Planning Department
10 Park Plaza
Boston, MA 02116
TAG
973-5390

David Graber
118 Larson Road
Stoughton, MA 02072
TAG
341-0390

Sharon Dean
N.E. Aquarium
Central Wharf
Boston, MA 02110
TAG

Robert Duwart
US EPA
JFK Federal Bldg., Rm. 2100-B
Boston, MA 02203
565-3549

Susan Bregman
Boston Traffic and Parking
Boston City Hall
Boston, MA 02201
TAG
565-3549

Boston Traffic and Parking
Boston City Hall
Boston, MA 02201
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725-4000

Leigh Bridges
Dept. of Fisheries, Wildlife &
Env. Enf.
100 Cambridge Street, 19th Floor
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727-3193

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Executive Office of Economic Affairs
1 Ashburton Place
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TAG
727-8380

Steve Lipman
DEQE/DWPC
One Winter Street
Boston, MA 02108
TAG
292-5698

Christopher Mantzaris
US Nat'l Marine Fisheries Serv.
14 Elm Street
Gloucester, MA 01930
TAG

Eric Buehrens
Department of Environmental Mgmt.
225 Friend Street
Boston, MA 02114
TAG
727-3160

Ken Carr
US Fish & Wildlife Service
P.O. Box 1518
Concord, NH 03301
TAG

TABLE 9-3
PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1986-1987

Project/ Activity	October	November	January	February
CAC Meeting	10/27 Intro.	11/24 Public Participation Workplans	1/5 Mitigation commitments and planning; Conceptual Site Layouts (Harbor Perspectives); Flows and Loads (preliminary).	2/2 Flows and Loads Environmental Scoping
General CAC Issues		CAC Organization Chairperson		Agenda review next quarter

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1986-1987

Project/ Activity	October	November	January	February
Sub Committees				2/2 Scoping
Community Meetings Hearings & Forums			2 Community meetings (STFP Harbor Perspectives); Winthrop 12/18 & Quincy 1/15	Forum 1/22
Distribution of Materials		Harbor Perspective Report		Draft reports: - Flows and Loads - Environmental Review Scope

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1987

Project/ Activity	February	March	April	May
CAC Meeting	2/23 Discuss Flows & Loads (WWTP size); Outfall Environmental Scope	3/23 Draft reports: - Outfall - Evaluation Criteria	4/27 Outfall; Power; Site Development	6/1 Special Meeting Site Tour Site Layouts
General CAC Issues			Agenda review	

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1987

Project/ Activity	February	March	April	May
Subcommittees	Outfall siting	Evaluation Criteria 3/19 & 3/31 Outfall 3/10 & 3/20	Outfall 4/16	
Community Meetings Hearings & Forums		2 Public Meetings Outfall; Siting & Technology Screening); Quincy 3/12 & Lynn 3/18	2 Community workshops (Site Layout) Winthrop 4/22 & Quincy 4/30	
Distribution of Materials	Drafts: - Evaluation Criteria - Outfall Siting			

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1987

Project/ Activity	June	July	August	September
CAC Meeting	6/29 EPA EIS Outfall Criteria Historical & Archaeological; Site Preparation	7/27 Outfall; Detailed Evaluation of Alternatives	8/24 Preliminary Implementation Schedule Outfall	9/28 Outfall; Implementation Schedule DEIR/EID
General CAC Issues		Agenda Review		

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1987

Project/ Activity	June	July	August	September
Subcommittees Subcommittees	Outfall Siting Criteria	(Treatment Processes; Site Layouts; Vol. II; Outfall	Outfall Inter-Island (Vol. IV)	
Committee Meetings Hearings & Forums Inter-Island		2 Committee Workshops. (Site Preparation/ (Outfall) N.&S. Public Meeting Boston, 7/22 (Site Preparation Inter-Island)		2 Committee Workshops. (Outfall) N. & S. Shore 1 Public Meeting (FP/EIR recommendations.)
Distribution of Materials	Evaluation Criteria (non-outfall)	Tech. Memo: Treatment Processes. & Site Layouts	Tech. Memo.: Estimated Costs: Draft Vol. II Status Report Mitigation	Status Report: Implementation schedule Draft Vol. IV*

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1987-1988

Project/ Activity	October	November	December	January
CAC Meeting	Draft Facilities Plan Environmental Review Vol III* Vol IV* Vol V* Treatment Plant Performance	Facilities Plan Environmental Review	Facilities Plan Environmentl Review	Facilities Plan Environmental Review
General CAC Issues	Agenda review			Agenda review

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1987-1988

Project/ Activity	October	November	December	January
Subcommittees				
Committee Meetings/ Hearings & Forum	Public Hearing (3 locations, Vols. II, IV, & VI)*	Facilities Plan/EIR Hearing (3 locations, Vols. I, III, & VII)* 2 Outfall Public Meetings		Forum Outfall Hearing (3 locations, Vol. V)*
Distribution of Materials	Draft Vol. I* Draft Vol. III* Draft Vol. V* Draft Vol. VII* Final Vol. VI* Draft Miti- gation	Supplemental Vol. V*	Final Vol. II* FInal Vol. IV*	

PUBLIC PARTICIPATION SUMMARY
MEETINGS FOR 1988

Project/ Activity	February	March	April	May
CAC Meeting	Facilities Plan Env. Review			
General CAC Issues				
Subcommittees				
Committee Meetings/ Hearings & Forum				Forum
Distribution of Materials	Final Vol. I* Final Vol. III* Final Vol. V* Final Vol. VII*			

*Key to Volumes:

Vol. I - Executive Summary
Vol. II - Planning Background - Flows & Loads, Water Quality, Waste Characterization
Vol. III - Treatment Plant
Vol. IV - Inter-Island Conveyance System
Vol. V - Outfall

Vol. VI - Early Site Preparation
Vol. VII - Institutional Considerations

WATER RESOURCES AUTHORITY
MASSACHUSETTS